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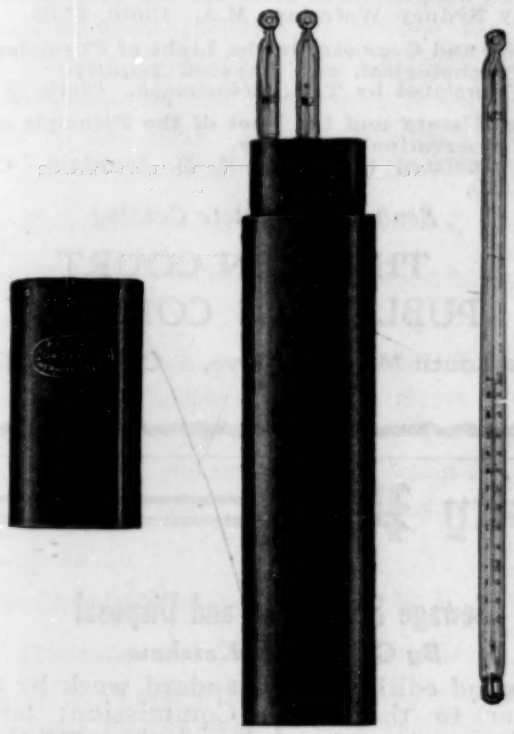

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OPERATIVE VERSUS ABSTRACT PHILOSOPHY IN PHYSICS

THE limited usefulness in science of what we may, perhaps, call verbal philosophy has long been recognized, especially in the mathematical sciences. Unfortunately the term verbal philosophy conveys a suggestion of contempt, whereas no contempt whatever is here intended. By verbal philosophy we mean the marvelously effective method of thinking which all men use in their dealings with the complex problems of daily life, a method of which the most striking characteristic is the transformation of the essential phases of a problem into verbal forms, not solely for purposes of articulate speech, by any means, but to facilitate thought.

My own opinion is that the training of the mathematical physicist is vastly inferior to the training of a good lawyer as a preparation for dealing with complex human problems, and the lawyer's training is in verbal philosophy. I must not, however, let this statement stand unqualified, for it needs to be qualified in two ways. In the first place scientific men would like to see the training of a lawyer arranged so as to lead to mental honesty as certainly as the training of the scientist, and in the second place scientific men would like to see a wider recognition among men of affairs (meaning the men who use what we have called verbal philosophy with great success in dealing with the almost infinitely complicated problems of practical life) of the fact that in every problem we face in this world the philosophy of precise ideas has come to have a place and that in most purely physical problems the philosophy of precise ideas is supreme.

Every person with whom I have ever talked, theorist or practician, student-in-general or specialist in whatever line, has exhibited more or less distinctly an attitude of impatience towards this or that phase of the precise modes of thought of the mathematical sciences.

> Da wird der Geist euch wohl dressirt
> In spanische Stiefeln eingeschnürt
> (There, alas, the spirit is constrained
> And laced in a Spanish corselet)

Nothing, however, is so essential in the mathematical sciences as the possession of precise ideas. One must think so and so, there is no other way. And yet there is always a conflict in the mind even of the most willing student because of the narrowing

influence which precise ideas exercise over our vivid and primitively adequate sense of physical things. This conflict is perennial, and it is by no means a one-sided conflict between mere crudity and refinement because refinement ignores many things. Precise ideas not only help most wonderfully to form our sense of the world in which we live, but they inhibit sense as well, and their complete and unchallenged rule would be a dreadful thing.

> Grau, theurer Freund, ist alle Theorie,
> Und grün des Lebens goldener Baum.
> (All theory, my friend, is somber, gray;
> And only the tree of life is green.)

It is the purpose of this brief article to set forth some of the little known characteristics of the philosophy of physics; of course it is not necessary to dwell on the best known phase of this philosophy, which is the use of the precise ideas of geometry.

A coin is rubbed on a board, work is expended on the coin and the coin undergoes a thermal change (the coin is heated). Let us suppose, for the sake of simplicity, that the only effect produced by the rubbing is the heating of the coin; then, if the coin were to be brought back to its initial condition by being brought into contact with another cooler body *B*, it would be found that the thermal effect produced in *B* is exactly what would be produced in *B* if the work expended on the coin were expended on *B* directly. Therefore, the coin, by virtue of the thermal change produced in it, has within itself something which is the equivalent of the work which has been expended on it, and this something is called heat. The definite outcome of these somewhat idealized operations involves the complete definition of heat as a form of energy, a definition which is sometimes called the first law of thermodynamics. If you do not believe it, try it! Every definition, every statement of principle or law in physics, rightly understood, is an actual operation, something done with the hands. How would you define a cow pasture? The answer is, by building a fence around it. Even a stupid cow pays attention to such a definition.

I am tempted to show the reduction of the principle of the conservation of energy in its purely mechanical aspects to an actual operation, but it is too long a story;[1] but the purely mechanical principle is the outcome of a very definite group of operations, and the above described operational aspect of the first law of thermodynamics supplements the purely mechanical principle of conservation, giving us the complete principle of the conservation of energy. Most men, most physicists even (for we are all lawyers in our predilection for verbal philosophy) are content to think that they think that "energy can neither be created nor destroyed." Nothing is easier to hold in mind than this verbal statement, and few things are more difficult to hold clearly in mind than the complete operational aspects of the principle of the conservation of energy.

And now for a matter that has been discussed *ad nauseam* by physics people. What is meant by mass? Of course the question so asked would seem to call for an answer covering every known relation of mass; this is a long story, but even so the story should start with a tenable definition. "Mass is quantity of matter"—nonsense! Mass is a physical quantity, and, surely, when we ask about a physical quantity we should consider the measurement of the quantity. Every advanced student of geometry knows, for example, that the meaning of length is bound up in its measurement. The only definition of mass for which one need offer no apology whatever is that the mass of a body is what you get when you weigh the body on a balance; this is the operational definition, but, because mass, like most quantitative ideas in physics, has many relations and because the relations of mass to force and acceleration are so remarkable, we forget ourselves and pretend to define mass in terms of acceleration, whereas neither the workers in the International Bureau of Weights and Measures nor your coal-man measures mass by jerking things around! You can easily frame up an operational definition of mass in terms of jerking, but measurement by the balance is the most precise measurement known, and the operation of weighing by the balance *is* the definition of mass in spite of any amount of reverence for Newton's laws of motion and in spite of any amount of verbal philosophy that may be brought to bear on the question. What you get when you weigh a body on a balance is independent of time and location, it is always the same for the given body, and it is for this reason that this result is a convenient measure for the amount of material in the body. The term weight as used in commerce (forget the spring scale as a device for weighing) means precisely the same thing as the word mass as used in science, and it is very greatly to the discredit of engineers that after agreeing to use the word weight in a different sense (meaning the force with which the earth pulls on a body) they revert to the usage of the coal-man, forgetting that the balance scale *does not* determine the weight of a body in the force sense.

In many cases the operational aspects of a principle or definition are difficult to hold in mind, thinking in terms of actual operations is very difficult; but operational philosophy *is* physics, and the diffi-

[1] See pages 68 to 70 of Franklin & MacNutt's "General Physics," McGraw Hill Co., New York, 1916.

ulty of thinking in terms of operations is the difficulty of physics. What are you going to do about it? One thing we all do is to introduce terms and phrases, such as electric current, voltage, resistance, candle-power, 100° C., which relieve us of the necessity of long wordy specifications of underlying operations in making statements of physical facts, and which, unfortunately, mislead many men into the easy acceptance of physics as a purely verbal philosophy; and the utmost limit of this pseudo physics is reached when in answer to a question as to the behavior of a body when acted upon by an unbalanced force the student answers *eff equals em aye!*

The most needed thing in physics is a logical scheme for facilitating our thinking in terms of operations, and it looks as if the phase of mathematics which is called the group theory might some day supply the much needed scheme. At any rate the operational aspect of physics sets physics apart from the familiar kind of pure mathematics, and, whereas, pure mathematics is the philosophy of precise ideas, physics is a philosophy of precise ideas and of operations. In both of these respects physics is to be contrasted with the age-old type of human philosophy in which the well-trained lawyer and the man of affairs excel.

An extremely remarkable thing in science is that highly complex and penetrating interpretations are forced upon the almost unthinkably meager data which we obtain directly through our senses. An astronomer, for example, *looks at a speck of light* as it crosses the field of his telescope and he *listens to the beats of a clock,* noting the time of day when the speck of light crosses the center of the field. He then *looks at a set of finely engraved lines* on a divided circle, noting the angular distance of the speck of light above the horizon. All this he does three times in succession. Then, proceeding to interpret his data, he calculates when the speck of light (a comet) will be nearest the sun, how far it will then be from the sun, how fast it will be moving, and when it will return, perhaps a hundred years hence. This kind of forced interpretation is very common in physics and chemistry, and in most cases the actual sense data are so extremely meager that to the layman they seem to be absurdly inadequate.

Another equally remarkable thing in the physical sciences is that we have learned to exercise over physical things a kind of rational control which greatly transcends the cunning of the most skilful hand. A generation or two ago the most remarkable physical things grew out of manual skill; but the most remarkable physical things are now such things as the Boston Edison System, the modern steamship and the complicated radio set, and, as everyone knows, the design, construction and operation of such things depends so largely on the understanding that we almost forget the element of manual skill.

Francis Bacon long ago listed in his quaint way the things which seemed to him most needful for the advancement of human knowledge or power. Among other things, he mentioned "A New Engine or a help to the mind corresponding to tools for the hand"; and the most important aspect of the modern mathematical sciences is the aspect in which they constitute a realization of Bacon's idea. These sciences do certainly constitute a new engine which helps the mind as a tool helps the hand, and it is this engine which makes possible all forced interpretation and all rational control.

This new engine is in part a *mechanical structure.* Consider, for example, the carefully planned arrangement of apparatus and the wide variety of related operations that are involved in any experimental study in the physical or chemical laboratory. The experimental data of the physicist and chemist are as meager as the astronomer's data and they take on meaning and bear a complex interpretation very largely because of the complex arrangement of apparatus and because of the inter-related operations, and, of course, the scheme of operations as well as the arrangement of apparatus is a mechanical structure.

The new engine is also in part a *logical structure,* that is to say, a closely reasoned body of mathematical and conceptual theory.

These two structures do indeed constitute a new engine, and the teaching of the physical sciences is the building of this engine: (a) By developing the logical structure of the sciences in the mind of a young man, (b) by training in the use of measuring instruments and in the performance of ordered operations, and (c) by exercise in the application of these things to the phenomena of physics and chemistry at every step, and all the time, with every possible variation. Let one reflect how very different this all is from the training of a lawyer; and let us remember that the scientist is a man and sure to be proficient, according to his native ability, in the type of philosophy that is needful in human affairs. It would seem that some training in science, some training in the only ways in which we can think about and deal with physical things, is needful for the lawyer and for the man of affairs.

WM. S. FRANKLIN
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

JULIUS ROBERT MAYER AND THE BLOOD'S CIRCULATION RATE

THE scientist appears most transcendent when he reaches a correct generalization by reasoning from instances which do not belong to the rule. Once a concept is suggested and formulated in the mind of the observer, the path which first guided may seem to be no longer of moment. The initial hypothesis then becomes a foolish incidental; it takes more than ordinary candor to admit the groundlessness of the first aberrant step. And the history of science is deficient in the details from which one might study the psychology of discovery.

One case in which the original wild guess has been recorded by its author occurred in the formulation of one of the greatest generalizations of science. The principle of the conservation of energy, the law which has unified many sciences into one, was undoubtedly first conceived by Julius Robert Mayer. But Mayer was not a physicist except by his fruits; he was a poor village physician, and his discovery resulted from apparently insignificant observations upon patients. A physician of mediocre ability may come to be classed in the best scientific society, when he pursues his thoughts as persistently as Mayer did.

Mayer was a native of Heilbronn, Germany, and received a routine training in medicine at the nearby University of Tübingen, and later at Munich. To see the world Mayer went in 1840, at the age of 26, as ship's surgeon on a Dutch freighter to Java. While bleeding patients in torrid Java he was struck with the unusually bright red color of the blood which came from the patients' veins. It was from this observation, by a chain of reasoning which involved assumptions now known to be physiologically incorrect, that Mayer arrived at a surprisingly adequate conception of the protean forces of nature.

Though ultimately Mayer became known as a theoretical physicist, primarily he was and remained a physician. His very method of mental procedure was that of the clinician to-day, a method which, juggle it as one will, always remains strikingly contrasted to that of the laboratory scientist, because of the infinite number of variables in a single clinical problem. Mayer reasoned from a few selected observations upon phenomena having many conditions not in common, to a generalization which then served as a guide for selecting other observations as they were met. His method in physical science was comparable to observing several cases of jaundice, demonstrating that they were accompanied by abnormal conditions in the liver, and thenceforth taking notice of those phenomena which by supposition bore information concerning the activities of the liver. Mayer spoke with authority in a circumscribed province of the sort in which the liver specialist holds sway; in other things he was more nearly a fool. Mayer's inexact methods were the forerunners of the precise work of Joule; while the latter's quantitative proofs immediately placed Mayer's reasoning and results out of date.

Mayer described the course of induction which led to his great generalization in the following words:[1]

> In the summer of 1840, on the occasion of bleeding Europeans newly arrived in Java, I made the observation that the blood drawn from the vein of the arm possessed, almost without exception, a surprisingly bright red colour.
>
> This phenomenon riveted my earnest attention. Starting from Lavoisier's theory, according to which animal heat is the result of a process of combustion, I regarded the twofold change of colour which the blood undergoes in the capillaries as a sensible sign—as the visible indication—of an oxidation going on in the blood. In order that the human body may be kept at a uniform temperature, the *development* of heat within it must bear a quantitative relation to the heat *which it loses*—a relation, that is, to the temperature of the surrounding medium; and hence both the production of heat and the process of oxidation, as well as the *difference in colour* of the *two kinds of blood*, must be on the whole less in the torrid zones than in colder regions.
>
> In accordance with this theory, and having regard to the known physiological facts which bear upon the question, the blood must be regarded as a fermenting liquid undergoing slow combustion, whose most important function—that is, sustaining the process of combustion—is fulfilled without the constituents of the blood (with the exception, that is, of the products of decomposition) leaving the cavities of the blood-vessels or coming into such relation with the organs that an interchange of matter can take place. This may be thus stated in other words: by far the greater part of the assimilated food is burned in the cavities of the blood-vessels themselves, for the purpose of producing a physical effect, and a comparatively small quantity only serves the less important end of ultimately entering the substance of the organs themselves, so as to occasion growth and the renewal of the worn-out solid parts.
>
> If hence it follows that a general balance must be struck in the organism between receipts and expenditure, or between work done and wear and tear, it is unmistakably one of the most important problems with which the physiologist has to deal, to make himself as thoroughly acquainted as it is possible for him to be with the budget of the object of his examination. The wear and tear consists in the amount of matter consumed; the work done is the evolution of heat. . . . The physiological theory of combustion starts from the fundamental proposition, that the quantity of heat which results from

[1] Mayer, J. R., 1851: "The Mechanical Equivalent of Heat." Transl. by J. C. Foster in "The Correlation and Conservation of Forces," edited by E. L. Youmans, New York, 1864, pages 324–325.

the combustion of a given substance is *invariable*. . . . Hence it follows, no less inevitably, that the heat produced mechanically by the organism must bear an invariable quantitative relation to the work expected in producing it.

Mayer's conclusion[2] was first published in 1842. Let us try to travel again over his course of reasoning, but with the enlightenment of present-day knowledge.

With the discovery of oxygen it was proven[3,4] that without oxygen there could be no combustion and that oxygen was used up in both respiration and in ordinary combustion. Therefore, reasoned Mayer, the amount of oxygen supplied must be a measure of the amount of combustion going on. This was nothing new, but Mayer was the first to whom a further implication became deeply significant, namely, that the amount of heat produced by respiration must be not only proportional to, but also quantitatively derived from, the amount of oxygen used up. Such a thought had apparently never impressed Lavoisier. Mayer next showed his physician's conception of the economy of the living body. Assuming that the redness of the blood is a semi-quantitative measure of its oxygen content, the unusual redness observed in a hot climate must represent a saving on the organism's part. If the chief end of oxygen utilization is the production of heat to maintain the body's temperature, then a saving of oxygen must mean that less heat is required for temperature maintenance. Eventually Mayer drew from these logical steps his epoch-making conclusions that an oxidative chemical reaction is a quantitative conversion of chemical energy into heat, and ultimately that all "forces" are quantitatively convertible into one another.

Now no one in Mayer's day, and least of all a physicist, could have found any fallacy in this correlation of physical and physiological facts. It has remained for the physiology of the subsequent century, and chiefly that of the last decade, to find any. It turns out that Mayer's reasoning was wrong in the very first step, in the inference "having regard to the known physiological facts" that the color of the blood in the veins is a measure of rate at which oxygen is being consumed in the part of the body which it drains. What physiologist of 1842 could have conceived of the velocity of the blood's flow as a highly variable quantity? The arteries were thought to carry the blood passively in every sense;[5] surely of all the tissues the circulatory vessels did their work regardless of conditions in the body. Or who would have supposed that the quantity of blood in the system might alter rapidly and reversibly?[6] Indeed the conception of the blood system as a constant delivery pumping plant has been overthrown only in the last twenty-five years.

Let us see what intricate and numerous facts have to be understood before one can describe fully the relation between the body's temperature and the rate of oxygen consumption by the tissues from which a given vein brings blood.

The great teacher of physiology, Carl Ludwig, carried out some of his earliest researches[7] upon the regulation of the blood's circulation. It seems none too dogmatic to say that William Harvey's[8] calculation of the amount of the heart's output had been the first and last contribution to the quantitative study of the blood's circulation up to Ludwig's time. Ludwig's work dealt chiefly with the blood supply to particular parts of the organism. It was, indeed, impossible to study the effects of various influences upon the local circulation until the circulation as a whole could be measured in a normal individual. This has been accomplished only recently.[9,10,11] Thanks to the importance of the problem, however, many measurements of total circulation rate, that is, of the heart's output of blood, have been made by many methods, and the effects of exercise and the like have been studied.[10,12,13] The influence of a

[2] Mayer, J. R., 1842: "Bemerkungen über die Kräfte der unbelebten Natur." *Ann. d. Chem., 42,* 233–240.

[3] Priestley, J., 1772: "Observations on Different Kinds of Air." *Phil. Trans., 62,* 147–252.

[4] Lavoisier, A. L., 1777: "Expériences sur la respiration des animaux et sur les changements qui arrivent à l'air en passant par leur poumon." *Mém. Acad. Sci.,* 1777, 185–194.

[5] Young, T., 1809: "On the Function of the Heart and Arteries." *Phil. Trans.,* 1809, 1–31.

[6] Barcroft, J., *et al.,* 1922: "On the Relation of External Temperature to Blood Volume." *Phil. Trans., 211* B, 455–464.

[7] Ludwig, C., 1847: "Beiträge zur Kenntniss des Einflusses der Respirations-bewegungen auf den Blutlauf im Aortensystem." *Arch. f. Physiol.,* 1847, 242–302.

[8] Harvey, W., 1628: "De motu cordis et sanguinis." Frankfort-am-Main. English transl. by R. Willis, London, 1847, chapter 9.

[9] Krogh, A., and Lindhard, J., 1912: "Measurements of the Blood Flow through the Lungs of Man." *Skand. Arch. Physiol., 27,* 100–125.

[10] Douglas, C. G., and Haldane, J. S., 1922: "The Regulation of the General Circulation Rate in Man." *Jour. Physiol., 56,* 69–100.

[11] Henderson, Y., and Haggard, H. W., 1925: "The Circulation and its Measurement." *Amer. Jour. Physiol., 73,* 193–253.

[12] Boothby, W. M., 1915: "A Determination of the Circulation Rate in Man at Rest and at Work. The Regulation of the Circulation." *Amer. Jour. Physiol., 38,* 383–417.

[13] Lindhard, J., 1915: "Ueber das Minutenvolum des Herzens bei Ruhe und bei Muskelarbeit." *Arch. gesam. Physiol., 161,* 233–383.

hot environment or of unusual internal heat production upon the total circulation rate has only just been investigated.[13, 14] We can say with certainty that the total circulation rate always increases, but only by a comparatively small amount, as a result of the exposure of the body to heat. When heating effects have become excessive, however, there ultimately comes on a slowing of the circulation, and it appears that "heat stroke" is a failure of the supply of fresh blood in essential tissues.[15]

At the present day it can be realized that complete information regarding the total circulation rate can furnish only a part of what one needs to answer a problem such as Mayer had before him. By a dramatic observation Claude Bernard had discovered[16] in 1852 that arteries are under the control of nerves; that locally vessels may expand or contract when certain nerves are stimulated. Investigations of the local control of arterial caliber have brought to light a great variety of influence upon, and of resulting variations in, the flow of blood through individual arteries.[17, 18] And recently several investigators[19, 20, 21] have completed the demonstration that the capillaries and venules are highly changeable and are under an equal number of combinations of nervous and chemical influences.

It is precisely these local vascular changes in caliber, capacity and elasticity which have been found to be extremely responsive to temperature changes of the body and of the environment. And it can be demonstrated at last that temperature changes in body and environment normally influence the body in the same way, for it is the skin, in touch with both body and environment, which first detects the temperature changes, and initiates and regulates the responses of the circulatory system.[15]

Studies[22, 23] of local temperature stimulation go to show that the rate of blood flow in the arms, the very parts of the body which were observed by Mayer, may be augmented or decreased many fold by warming the skin. The demonstration that the venous blood of the arm comes to have the same oxygen content as the arterial blood leaving the heart, when the arm is simply warmed in water for ten minutes at 45° C.,[24] is a refined repetition of Mayer's basic observation. Yet it must be recognized that the blood's color is not directly proportional to its oxygen content,[25] and that the color which the blood confers upon the skin is a very erroneous index of metabolic conditions.[26] The difference in interpreting the observation which Mayer grasped at, which eighty-five years have made, is this: we now know that the high oxygen content of venous blood under the influence of a warm environment is due entirely to the extreme rapidity of blood flow. The rate of oxygen consumption in the arm or by the body can be measured accurately, and it has been found with certainty[27, 28] that, if anything, slightly more oxygen is used at such a time than is used at ordinary temperatures. But the rate of flow becomes so rapid that each portion of blood loses an almost immeasurably small percentage of its oxygen content.[29] The body is not saving on the production of heat.

The true physiological explanation of what Mayer observed under conditions of high temperature seems to be that, although the metabolic rate and circula-

[13] Barcroft, J., and Marshall, E. K., Jr., 1923: "Note on the Effect of External Temperature on the Circulation in Man." *Jour. Physiol., 58,* 145–156.

[14] Adolph, E. F., 1924: "The Effects of Exposure to High Temperatures upon the Circulation in Man." *Amer. Jour. Physiol., 67,* 573–588.

[15] Bernard, C., 1852: "Sur les effects de la section de la portion céphalique du grand sympathique." C. R. Soc. Biol., *4,* 168–170.

[16] Gaskell, W. H., 1880: "On the Tonicity of the Heart and Blood Vessels." *Jour. Physiol., 3,* 48–75.

[17] Bayliss, W. M., 1923: "The Vaso-motor System." London.

[18] Hooker, D. R., 1920: "The Functional Activity of the Capillaries and Venules." *Amer. Jour. Physiol., 54,* 30–54.

[19] Parrisius, W., 1921: "Zur Frage der Contractilität der menschlichen Hautcapillaren." *Arch. gesam. Physiol., 191,* 217–233.

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[28] Goldschmidt, S., and Light, A. B., 1925: "The Effect of Local Temperature upon the Peripheral Circulation and Metabolism of Tissues as Revealed by the Gaseous Content of Venous Blood." *Amer. Jour. Physiol., 73,* 146–172.

tion rate increase 10 or 25 or 50 per cent. throughout the body, depending upon the degree of the temperature influence, the circulation rate *through the extremities* increases several hundred per cent., thus conveying heat to surfaces where it may be dissipated.[30] Under the majority of circumstances, and in Java, this is a provision for cooling the organism which is far more effective than that of which Mayer conceived.

There was in Mayer's day a physiological teaching which, had it been true, would have overthrown his reasoning still more thoroughly. This was the idea, which originated with Lavoisier,[31] that all or most of the body's oxidations occur in the lungs. It is probable that Mayer as a medical student had been taught this; whether he promptly forgot it or whether he was too wise to accept it, we can not discern. It is clear that if oxidations really occur in the lungs, then the color of the venous blood could tell nothing about the rate of combustion in the body as a whole. The view taken by Mayer, that combustion occurs chiefly or solely within the blood itself while in the capillaries, is no more correct in theory, and much less sanctioned by tradition.

To infer from the color of the blood in the skin the condition of the blood over the whole body was perhaps Mayer's biggest fallacy. But who does not reason just as "superficially" in the present year of enlightenment? Fallacies are not created by laziness, even in Mayer's case. In later life Mayer's mind gave way before the stupendous and intricate conceptions of the universe to which he was led. He was taken to an insane asylum, but later recovered equilibrium, and spent the rest of his days in the simpler occupation of cultivating the vine.

It must have been beyond Mayer's conception actually to measure the rate of blood flow through a vein, or the rate of oxygen consumption in a living arm, or even the oxygen saturation of venous blood. Yet to-day the solution of such a minor problem as the effect of temperature conditions upon the utilization of oxygen in the tissues drained by a given vein has just been begun; indeed, it is only now that the physiological value of a given atmospheric temperature can be accurately known in terms of physical measurements.[32] Scientists and non-scientists talk more about climate than about any other one topic; and the circulatory system is the portion of us whose relation to the weather ultimately matters most.

Mayer's contribution to the recognition of the principle of the conservation of energy was purely qualitative; he came to deal with energy in a cosmical way, a useful way which a thorough physicist like Joule could not permit himself to take. Shall we suppose that if Mayer had known the truth about the red color of febrile venous blood he would never have discovered the equivalence between chemical energy and heat?

EDWARD F. ADOLPH
UNIVERSITY OF ROCHESTER

[30] Goldschmidt, S., and Light, A. B., 1925: "A Comparison of the Gaseous Content of Blood from Veins of the Forearm and the Dorsal Surface of the Hand as Indicative of Blood Flow and Metabolic Differences in These Parts." *Amer. Jour. Physiol., 73,* 127–145.

[31] *Loc. cit.*

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JOHN J. FLATHER

THE death of Professor John J. Flather of the University of Minnesota which occurred on Friday, May 14, 1926, at his home in Minneapolis, came as a surprise and a shock to his many friends. Although he had not been in the best of health for several years, his usual energy enabled him to perform his full duty as a teacher and as the administrative head of the department of mechanical engineering. Quite recently he has had trouble with his heart and just a day or two before his death his physician ordered a complete rest and cessation of all active work. Professor Flather was at the university up to the day before his death.

Professor Flather was born at Philadelphia, June 9, 1862. His father was English and his mother a native of Virginia. He was educated in private schools in Scotland, and the high school at Bridgeport, Conn., later attending Yale University where he graduated in 1883. He did graduate study at Cornell University and received the degree of Master of Mechanical Engineering in 1890. He also studied at the University of Edinburgh.

The early professional experience of Professor Flather includes a full apprenticeship in various machine shops in New England, journeyman experience as a toolmaker for the Yale & Towne Mfg. Co., designer and foreman for the Ansonia Electric Co., and superintendent of the Buffalo Steam Pump Co., and afterwards of the Hotchkiss Mfg. Co. of Bridgeport, Conn.

In 1888, he began his teaching work as instructor in mechanical engineering at Lehigh University, where he remained three years. From 1891 to 1898, he was professor of mechanical engineering at Purdue University. He came to the University of Minnesota in 1898 as professor of mechanical engineering and head of the department, which position he held until his death. He has taught practically all the subjects in the mechanical engineering curriculum at some time

during his career. His department has developed under his leadership and guidance from a small unit to a group of nearly 200 students and a faculty and staff of twenty-five. Many prominent mechanical engineers and engineering teachers are the product of this department.

Professor Flather has taken an active part as consulting engineer in many important engineering projects in the Northwest. Among these are municipal water works, electric light plants, factories and power plants. He designed the heating plants for the University of Minnesota on the main campus and the farm campus. He also conducted many researches and investigations, especially along lines of mechanical power development, transmission and measurement, and the design of tall chimneys.

His articles in the technical journals have been numerous and cover a broad field. He is the author of books on rope driving, dynamometers and the measurement of power, and kinematics, and joint author of books on steam boilers and engineering thermodynamics. At the time of his death he had partially completed a work on the history of engineering.

He was a member of various societies, principally scientific and technical, including the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, Society of Industrial Engineers, Minneapolis Engineers' Club, American Association for the Advancement of Science (secretary and vice-president of Section D), Society for the Promotion of Engineering Education (treasurer and later vice-president), American Association of University Professors and the honorary societies Sigma Xi, Tau Beta Pi, and Pi Tau Sigma. He was also a member of the Authors' Club and the Newcomen Society of London.

Professor Flather was a cultured gentleman of broad vision. Outside of his professional and scientific interests, his tastes ran to literature. He enjoyed a wide acquaintanceship throughout the United States and in various foreign countries. He was a delightful conversationalist, versed in many subjects.

Professor Flather is survived by his widow, a daughter, Elizabeth, who is a senior at the University of Minnesota, and a brother, Herbert Flather, of Meriden, Conn.

O. M. LELAND

UNIVERSITY OF MINNESOTA

SCIENTIFIC EVENTS

THE COMMONWEALTH INSTITUTE OF SCIENCE AND INDUSTRY[1]

THE scheme proposed by Sir Frank Heath for the reorganization of the Commonwealth Institute of Science and Industry has been tabled in the Australian House of Representatives. The outstanding aim in the scheme is to obtain the utmost cooperation of all the states with the commonwealth in the formulation of advice through carefully selected men of responsible position and wide outlook, it being recognized that the vast distances of Australia and the wide range of its climates demand a degree of decentralization much greater than is necessary or desirable in a smaller and more populous country. It is recommended that the purposes of the institute be defined under three heads: (1) To provide for the training of young men and women in scientific research and for the encouragement of research workers who have already shown capacity for original work; (2) To take responsibility for conducting scientific investigations into problems of importance either (*a*) to the whole industrial activities of the commonwealth, whether primary or secondary, or (*b*) to the interests of Australian consumers as a whole; (3) To encourage and assist under suitable conditions the solution of scientific problems of importance to particular states or groups of states, which, though urgent in themselves, do not affect the whole dominion.

Three derivative functions for the Commonwealth Institute of Science and Industry are added to the main purposes set out in Sir Frank Heath's scheme for reorganization: (*a*) To act as a clearing-house for information on scientific matters affecting the industries of the country; (*b*) To act as the principal and official means of *liaison* in scientific matters between the governments of the commonwealth and those of Great Britain and other parts of the British Empire; (*c*) To become, as it wins the confidence of the world of industry and science, the adviser of the government on the scientific aspects of policy. It is proposed that the institute be constituted a body corporate consisting of the prime minister for the time being and an advisory council of a chairman and eight members, under the title of the Department of Research in Science and Industry. The chairman and two members are to be appointed by the governor-general and are to form an executive committee with very extensive powers. The other six members are to be the chairmen of state advisory committees. Each of the latter is to include two members nominated by the state government from its scientific staff, two members of the state university nominated by the Australian National Research Council, and two representatives of the principal industries of the state.

[1] *Nature.*

FEDERAL LEGISLATION

UNDER a bill (S. 41) to encourage and regulate the use of aircraft in commerce, which has been reported by the Senate Committee on Interstate and Foreign Commerce, the Secretary of Commerce would make

recommendations to the Secretary of Agriculture as to necessary meteorological service. The bill provides that it shall be the duty of the Weather Bureau to furnish such weather reports, forecasts, warnings and advices as may be required to promote the safety and efficiency of air navigation in the United States and above the high seas, particularly upon civil airways designated by the Secretary of Commerce.

Representative Winter, of Wyoming, has introduced a bill (H. R. 12066) to add certain public lands to the Washakie National Forest.

The Senate has passed a bill (S. 1640) authorizing the Secretary of Agriculture to establish a national arboretum. A committee amendment reduced the proposed appropriation for this bill from $500,000 to $300,000, and provided that the site shall be open for recreational purposes and for the purpose of research and education.

The Senate has also passed a bill (S. 2516) providing for the establishment and maintenance of a forest experiment station in Pennsylvania and the neighboring states. The bill carries an appropriation of $30,000. The Senate has also passed a bill (H. R. 292) authorizing the Secretary of Agriculture to acquire and maintain dams in the Minnesota National Forest for the administration of government land and timber, and also a bill (S. 3926) fixing standards for hampers, round-stave baskets and splint baskets for fruits and vegetables.

A bill (S. 4153) to provide for enlargement and relocating the United States Botanic Garden has been reported by the Senate Committee on the Library, without amendment.

THE CONTROL OF CANCER IN MASSACHUSETTS AND NEW YORK

DR. GEORGE H. BIGELOW, Massachusetts State Commissioner of public health, has announced the names of sixteen physicians and laymen who have accepted appointment to serve on an advisory committee to assist his department in carrying out the provisions of the cancer bill, passed by the legislature in the closing days of the session. Under the bill the Norfolk State Hospital is to be converted for use as a hospital for treatment of advanced stages of cancer, and $100,000 is appropriated for this purpose. The bill provides an additional $15,000 for the establishment of cancer clinics.

The advisory committee, as announced by Dr. Bigelow, is as follows: Dr. James S. Stone, president of the Massachusetts Medical Society; Dr. Walter P. Bowers, editor of the *Boston Medical and Surgical Journal;* Dr. Walter Burrage, secretary of the Massachusetts Medical Society; Dr. Robert B. Greenough, of the Harvard cancer commission and the Huntington Memorial Hospital; Dr. Franklin G. Balch, chairman of the Massachusetts section, American Society for the Control of Cancer; Richard K. Conant, state commissioner of public welfare; Dr. Henry M. Pollock, superintendent of the Massachusetts Homœopathic Hospital; Dr. J. W. Schereschewsky, United States Public Health Service; Robert W. Kelso, of the Boston Council of Social Agencies; Dr. G. Forest Martin, of Lowell, chairman of the board of trustees of the State Hospital at Tewksbury; Miss Ida M. Cannon, of the social service department, Massachusetts General Hospital; Dr. Edwin B. Wilson, department of vital statistics, Harvard School of Public Health; Rev. George P. O'Connor, Catholic Charitable Bureau; Dr. Kendall Emerson, of Worcester; Miss Gertrude W. Peabody, of the Massachusetts Association of Directors of Public Health Nursing, and Dr. Stephen Rushmore, dean of Tufts Medical School.

Plans for the establishment of a large medical center for the treatment of cancer were discussed on June 11, at the organization of the New York Cancer Association, Inc. A two-million-dollar hospital, extensive facilities for laboratory research and a highly organized welfare department to care for the families of cancer patients and to conduct an educational campaign will be the objects of the association, of which Sanders A. Wertheim, of 875 Park Avenue, was elected president.

The association, which is composed of physicians and private citizens, will work in close cooperation with the New York Cancer Institute. Bird S. Coler, commissioner of public welfare, who was instrumental in founding the institute, was elected chairman of the executive committee, and Dr. Isaac Levin, director of the institute, was named medical director.

Associated with Dr. Levin on the scientific committee are Dean Samuel A. Brown, of the university and Bellevue Hospital Medical College and president of the Academy of Medicine of New York; Dr. George D. Steward, president of the Medical Board of Bellevue Hospital; Dr. William H. Park, president of the American Health Association; Dr. Holmes C. Jackson, of the University and Bellevue Hospital Medical College; Dr. Barnet Josephs and Dr. Alfred D. Osgood.

PRESENTATION IN HONOR OF DR. B. F. KINGSBURY

ON Thursday afternoon, June 10, the graduate students of Dr. Benjamin Freeman Kingsbury presented to Cornell University a portrait of him, painted by Professor Olaf M. Brauner, in celebration of the completion of his thirty years of service in the faculty.

Dr. James G. Needham presided; Dr. Fred W. Stewart made the presentation address; Dr. Kingsbury's daughter, Marguerite, of the graduating class,

unveiled the portrait, and Professor William A. Hammond, secretary of the university faculty, accepted it in behalf of the university in the presence of a large assembly of Dr. Kingsbury's friends.

In the evening a dinner was given in his honor. Dr. Needham acted as toastmaster, and, after reading many greetings from those who could not be present, he introduced the speakers as follows: Professor Pierre A. Fish, fellow student and colleague; Dr. Christianna Smith, of Mount Holyoke College, for the women graduate students; Dr. Abram T. Kerr, secretary of the Ithaca Division of the Medical College; Dr. William R. Humphrey, of the University of Buffalo, for the men graduate students, and Emeritus Professor Simon Henry Gage, former teacher, colleague and predecessor.

Dr. Kingsbury's response made all feel that it was a rare privilege to gather in honor of a man with such noble ideals, such beautiful human qualities and who has been and is such an inspiring leader and trainer of men.

S. H. G.

THE GRABAU MEDAL

THE annual meeting of the Geological Society of China was held in Peking, from May 3 to 5. A noteworthy feature was the first presentation of the Grabau Medal, founded by Mr. C. Y. Wang, and named in honor of its first recipient, Professor Amadeus W. Grabau. This medal is to be awarded annually in recognition of accomplishment in the field of geological research in China, or for original advancement of the science throughout the world. It is the first gold medal in the gift of any scientific society in China, and it will be peculiarly gratifying to American scientists that its title and its first award are in honor of the achievements of one of their countrymen. Americans have in fact played a very prominent part in the recent advances in the geology of China—the work of Pumpelly, of Bailey Willis, of Huntington and others is already classic, and in the active field studies now under way Americans are taking a large share. Professor Grabau has contributed a series of admirable researches upon the invertebrate fossils and paleogeography of China and of Central Asia, but far more than that he has been the inspiration through teaching and example of a remarkable group of young Chinese geologists, whose activity and high standards of research will compare with the best of western science.

The presentation took place at the annual dinner of the society, a notable occasion, at which representatives of the leading scientific institutions of North China and many other guests, among them Dr .J. S. Lee, head of the department of geology of the National University; Dr. W. H. Wong, director of the Geological Survey of China; the director of the Bureau of Mines; Mr. Yin, first president of the Scientific Society of China; Dr. Bernard Read, of the Peking Society of Natural History; Mr. Sohtsn King, curator of the Natural History Institute, and his artist brother, Mr. Kungpah King; Mr. Yen, of the Board of Communications; Mr. McMurray, the American Minister; Dr. A. W. Grabau; Dr. R. K. S. Liu; Dr. Davidson Black, and others of Peking Union Medical College; Mr. Roger Greene, of the China Medical Board, and Mrs. Greene; Mr. and Mrs. Gist Gee; Mr. George B. Barbour, of Peking University; Mr. and Mrs. Daly; Dr. Mont. Reid; Dr. and Mrs. N. C. Nelson; Dr. W. D. Matthew, and other members of the American Museum Central Asiatic Expedition.

W. D. M.

PEKING,
MAY 9, 1926

SCIENTIFIC NOTES AND NEWS

THE degree of doctor of science was conferred on Dr. W. J. V. Osterhout, of the Rockefeller Institute for Medical Research, at the recent commencement of Brown University.

LEHIGH UNIVERSITY has conferred honorary degrees on Dr. Albert Sauveur, professor of metallurgy in Harvard University, and on Louis A. Olney, professor of chemistry in the Lowell, Mass., Textile School. Dr. Henry S. Pritchett, of the Carnegie Foundation for the Advancement of Teaching, gave the commencement address on "The Primary Aim of a College Education."

THE degree of doctor of letters has been conferred by the University of Nebraska on Mr. Francis La Flesche in recognition of his work in ethnology and his services to the state.

AT its commencement on June 7, Lafayette College conferred the honorary degree of doctor of science upon an alumnus, Thomas B. Holloway, professor of ophthalmology at the University of Pennsylvania, and the honorary degree of doctor of engineering on George Crowell Andrews, Buffalo, N. Y., water commissioner for the city of Buffalo; on William Lewis Plack, Philadelphia, Pa., president of the Pennsylvania State Association of the American Institute of Architects, and on William Elgin Wickenden, New York, N. Y., director of investigation of engineering education for the Society for the Promotion of Engineering Education.

THE University of New Hampshire has conferred the doctorate of science on Dr. Philip Wheelock Ayres, forester for the Society for the Protection of New Hampshire Forests.

PROFESSOR ALEXANDER PETRUNKEVITCH, of Yale University, was on June 9 the recipient of an honorary degree from the University of Porto Rico.

PROFESSOR G. H. PARKER, director of the Harvard Zoological Laboratory, has been elected an honorary fellow of the Massachusetts Medical Society.

DR. SMITH ELY JELLIFFE, of New York City, has been made a corresponding member of the Vienna Society of Psychiatry and Neurology.

EDWARD E. WALL, formerly director of public utilities, St. Louis, whose recent dismissal by Mayor Miller was the culmination of a disagreement over authority within the mayor's cabinet, was given a testimonial dinner on May 17 by the Associated Engineering Societies of St. Louis "in appreciation of his thirty-four years of public service."

A LUNCHEON in honor of Dr. Ing. Paul Reusch, retiring president of the Deutsches Museum in Munich and one of the foremost industrialists of Germany, was given at the Chamber of Commerce in New York on June 10 by the trustees of the Museums of the Peaceful Arts. A feature of the luncheon was the presentation by Dr. Reusch of certificates of membership on the board of the Deutsches Museum in Munich to Elbert H. Gary, Professor Michael I. Pupin, John W. Lieb, E. W. Rice, Jr., and Calvin W. Rice. Mr. Gary and L. F. Loree, president of the Delaware & Hudson Railroad, spoke.

PROFESSOR ETTORE MARCHIAFAVA has recently received a gold medal from the Italian government for his services to public health, and the London Tropical Medicine Society has awarded to him the Manson medal in recognition of his work on malaria.

PROFESSOR E. KRAEPELIN, Munich, has been awarded a fund for a five months' study in India of paralysis.

DR. ETIENNE BURNET, subdirector of the Pasteur Institute of Tunis, has been awarded the Tunis medical prize of 5,000 francs for his work on Mediterranean fever. He has also been nominated assistant director of the institute.

AT the May meeting of the Helminthological Society of Washington, the following officers were elected for the ensuing year: Dr. Benjamin Schwartz, Bureau of Animal Industry, *president;* Mr. J. R. Christie, Bureau of Plant Industry, *recording secretary;* Miss A. J. Speer, Hygienic Laboratory, *corresponding secretary.*

H. T. HERRICK has been appointed chemist in charge of the Color Laboratory of the Bureau of Chemistry of the U. S. Department of Agriculture.

DR. WARREN FRED FARAGHER, assistant director of the Mellon Institute, has accepted the directorship of the research laboratory of the Universal Oil Products Company, Chicago, Ill. He assumed his new work on June 1.

DR. GEORGE W. HOOVER has been selected as chief of the central inspection district, Bureau of Chemistry, to fill the vacancy caused by the death of R. E. Doolittle.

LEONARD H. CHURCH, for the past three years a member of the faculty of the electrical engineering department of the Kansas State Agricultural College, Manhattan, has joined the editorial staff of *The Electrical World* for the summer, with headquarters in New York.

H. K. PLANK, of the Bureau of Entomology, has resigned to accept a position with the Tropical Research Foundation in Cuba.

DR. A. F. KIDDER has resigned as agronomist, Agricultural Experiment Station, Louisiana State University, effective June 15, 1926, to accept a position of cotton breeder for the growers of Canete Valley in Peru. Mr. H. V. Geib, assistant professor of agronomy, at the Louisiana State University, has resigned and will go with him as assistant. They expect to sail from New York on July 22.

DR. VERNON KELLOGG, secretary of the National Research Council, will attend a special general assembly of the International Research Council, at which about thirty nations will be represented, in Brussels, on June 29 and following days. The principal matter to be given attention at this meeting is that of the admission of Germany to the council. The council was organized during the war by representatives of the allied and neutral nations and the Central European powers have not yet been admitted to the council.

PROFESSOR E. F. PHILLIPS, of the department of entomology, Cornell University, and Mrs. Phillips left for Europe on June 2. Professor Phillips is this year president of the International Apis Club and will preside at the annual general conference of that organization to be held in London, from August 5 to 7. Various organizations devoted to apiculture in Switzerland, France, England and Scotland have arranged special meetings during the time of his visits to those countries.

LESTER R. FORD, of the department of mathematics, of the Rice Institute, has been granted a year's leave of absence and will spend fifteen months of study and research in Europe.

DR. J. W. GRUNE, assistant professor of mineralogy and geology at the University of Minnesota, is leaving on August 15 for his sabbatical leave. He will study crystal structure and its application to mineralogy and geology with Professors F. Rinne and E. Schie-

bold, of the University of Leipzig. En route, he will present a paper before the Mineralogical Society of Germany at Duisberg.

DR. TRUMAN MICHELSON, ethnologist in the Bureau of American Ethnology, has left Washington for Tama, Iowa, to continue his ethnological and linguistic studies among the Algonquin Indians of that state.

DR. ALFRED P. DACHNOWSKI, of the Bureau of Plant Industry, sailed for Europe recently for the purpose of comparing areas of peat in other countries with different peat lands in this country. He will visit the experiment stations and institutes of several countries and make a study of the progress in peat investigations and peat-land agriculture.

THE annual Halley lecture of the University of Oxford was delivered on May 5 by Dr. G. M. B. Dobson, Lincoln College, university lecturer in meteorology, who took as his subject "The Uppermost Regions of the Earth's Atmosphere."

PROFESSOR HERBERT S. JENNINGS, of the Johns Hopkins University, gave an address on "Biology and Experimentation" on the occasion of the dedication on June 4 of the new Whitman Laboratory of Experimental Zoology at the University of Chicago, built at a cost of $100,000. An introductory appreciation of Charles Otis Whitman, the distinguished zoologist in whose memory the building is named, was given by Professor Frank R. Lillie, chairman of the university's department of zoology.

PROFESSOR GEORGE D. SHEPARDSON, head of the department of electrical engineering at the University of Minnesota, died at Florence, Italy, of pneumonia on May 26 while on a sabbatical leave of absence. Professor Shepardson was in his sixty-second year.

BENJAMIN E. CARTER, associate professor of mathematics at Colby College for the last sixteen years, died on June 11, aged sixty years.

SIR STEPHEN PAGET, founder of the British Research Defence Society and author of the biography of Sir Victor Horsley, died on May 8, aged seventy years.

VLADIMIR ANDREYEVITCH STEKLOV, the eminent mathematician, vice-president of the Russian Academy of Sciences, died on May 31 in the Crimea at the age of sixty-three years.

THE British Association for the Advancement of Science meets, as has already been reported in SCIENCE, at Oxford from August 4 to 11, under the presidency of the Prince of Wales. Joseph Wells, vice-chancellor of the University of Oxford, is chairman of the local executive committee, and, with his associates, is making plans for an exceptionally large meeting. The college halls will be thrown open for visitors, guides will be provided by the town and university, and every possible courtesy will be shown to those in attendance. The British Association has met at Oxford on four previous occasions, in 1832, 1847, 1860 and 1894. As a special feature, excursions are being arranged for Saturday, August 7, to Stratford-on-Avon, the Cotswolds, Reading University, Windsor Castle and river excursions to Abingdon and other points. The annual meeting of the association in 1927 will be held in Leeds.

THE German Association of Scientific Men and Physicians meets this year at Düsseldorf from September 19 to 26. Invitations to attend are extended to all scientific workers. The main topic is scientific research in relation to industry. There are fifteen scientific and nineteen medical sections. Correspondence should be addressed to Büro der 89 Versammlung der Gesellschaft Deutscher Naturforscher und Aerzte, Düsseldorf.

THE fiftieth session of the French Association for the Advancement of Sciences will be held at Lyons from July 26 to 31.

THE International Congress for Applied Mechanics will be held in Zurich, from September 12 to 18. Lectures have been promised by Professor P. W. Bridgman, of Harvard University; P. Debye, of Zurich; Professor T. Levi-Civita, of Rome, and Professor L. Prandtl, of Göttingen.

THE Fourth National Colloid Symposium was held at the Massachusetts Institute of Technology, on June 23, 24 and 25. Professor James W. McBain, Leverhulme professor of physical chemistry in the University of Bristol, England, was the guest-speaker.

AT the Philadelphia meeting of the American Chemical Society, next September, the section of the history of chemistry will hold a joint session with the division of chemical education. One feature will be papers devoted to special phases of chemistry during the last fifty years, not included in the memorial volume entitled "A Half-Century of Chemistry in America," is being prepared under the direction of a committee appointed from members of this section. Another feature is an exhibit of historical material relating to chemistry in America. Titles of papers for the Philadelphia meeting should be sent to the secretary of the section, Professor Lyman C. Newell, Boston University, 688 Boylston St., Boston, Mass.

THE one hundred and fortieth regular meeting of the American Physical Society will be held in Oakland, California, at the laboratory of physics of Mills College, in affiliation with the Pacific Division of the American Association for the Advancement of Sci-

ence. The meeting of the association includes a research conference, on Wednesday, June 16, and other meetings and excursions extending through Saturday, June 19. The meeting of the American Physical Society will be on June 17, the morning session beginning at 10.00 o'clock. The afternoon session will be a joint session with the Astronomical Society of the Pacific. Other meetings for the current seasons are as follows: November 26–27, 1926, Chicago; December 27–29, 1926, Philadelphia, annual meeting.

THE Commonwealth Fund has appropriated $400,000 for a comprehensive study under the auspices of the American Psychiatric Association of community mental hygiene.

Nature states that the Royal Society will receive from Messrs. Brunner, Mond and Co., Ltd., a donation of £500 in respect of the current year towards the cost of scientific papers on the physical side. The society will also receive a publication grant of £2,500 from H. M. Government during the current year. Both grants are available for helping the publications of other scientific societies as well as for assisting the separate publication of books, memoirs, etc., of a scientific nature.

AN expedition has sailed from Honolulu under the joint auspices of the Bernice P. Bishop Museum and the University of California. The party, which consists of Professor W. A. Setchell, of the department of botany at the University of California; J. M. Ostergaard, of the University of Hawaii; J. E. Hoffmeister, fellow of the Bishop Museum and professor of geology in the University of Rochester, and others, has selected for especial study Eua Island in the Tongan group. The primary intention in going to Eua, which is one of the eastern line of so-called coral islands in the Tongan group, is to study the aspects of the submerged reef and the emergent or elevated reefs representing at least six or seven different terraces in order to compare the situation with that on Fiji, Oahu of the Hawaiian Islands and others of the South Seas, as well as the barrier reefs of Australia, which it is hoped will throw light on the structure, development, origin and biological and geological history of the reefs throughout the Pacific.

UNIVERSITY AND EDUCATIONAL NOTES

AMONG bequests in the will of the late John Kennedy Tod are the sum of $250,000 to Princeton University and $100,000 to the Presbyterian Hospital, New York City.

GROUND was broken at Wellesley College on May 14 for a new building to house the departments of botany and zoology. The building will be erected at a cost of approximately $500,000.

DR. EDWARD MORGAN LEWIS, dean of the Massachusetts Agricultural College, was elected president on June 14. Dr. Lewis has been acting president since the resignation of Dr. Butterfield two years ago to become president of the Michigan Agricultural College.

DR. E. J. LUND, assistant professor of physiology at the University of Minnesota, has accepted a professorship of zoology at the University of Texas. Dr. Lund will have charge of the work in physiology in the department of zoology.

PROFESSOR HENRY MCE. KNOWER, formerly of the University of Cincinnati, has accepted appointment as head of the department of anatomy in the University of Alabama.

THE University of California announces the following changes in the staff of the department of physics: Dr. Marcus O'Day, instructor, has resigned to accept an assistant professorship at Reed College, Oregon. Samuel K. Allison, Ph.D. (Chicago), of the Geophysical Laboratory of the Carnegie Institution, has accepted the position left vacant by Dr. O'Day. To replace Edward Condon, assistant in the department, who has been granted a National Research Fellowship for the purpose of studying with Professor M. Born in Göttingen, the position has been given to Mr. Harold P. Knauss, a graduate of New York University, who is just returning from a year spent abroad under a Coffin Foundation Fellowship. Mr. Gerhard Dieke, of the University of Leiden, who will receive the Ph.D. degree in physics in September, has been granted an International Education Board Fellowship to work with Professor P. Epstein at the California Institute.

DISCUSSION

A PROGRAM FOR BIOLOGISTS

WITHIN the last few weeks three papers have come to hand which appear to be of more than ordinary importance, to say the least. One is C. C. Hurst on "Chromosomes and Characters in *Rosa*"; one is Morgan, Sturtevant and Bridges on the "Condition of the Germ Material in Relation to Heredity," and the third is Turesson on "Plant Species in Relation to Habitat and Climate." Taken together, these papers indicate the magnitude of recent advances in biological knowledge and corresponding theory. They have this in common that all are based on intensive studies, conceived from a broad point of view. They appear to indicate the direction in which we are moving, and where we may expect notable advances. To the ordi-

nary biological worker they may perhaps suggest some modification of current methods. Unquestionably all constructive work in taxonomy, morphology, cytology, physiology or genetics is of value, and will be built into the general structure of knowledge. But if *Drosophila* or *Rosa* had only been studied to the same extent and in the same manner as it is possible to study the majority of insects or plants, the advances we now herald might have been delayed some hundreds of years. The field is too great to be adequately covered in any near future. I have spent a good part of my life describing about three thousand five hundred supposed new species of bees, but the combined work of all bee-students to date leaves the subject in much the condition of a page of a book, on which each line contained only one or two words and a few scattered letters. It would be impossible to do more than guess at the nature of the narrative. The thing to do is to admit that the book can never be completed in our generation, but by concentrating on certain pages we may make them intelligible. They should be selected from diverse parts of the book. That is to say, it would be more profitable to study intensively and cooperatively certain groups of animals and plants, such as *Rosa, Salix, Viola* and *Crataegus* among flowering plants, *Helix* and its allies among snails, *Drosophila* and its allies among flies, the Saturniidae among moths, and so forth. I mention some of the groups which are being intensively studied, but even in the *Drosophila* group much more might be done. The world is inhabited by great numbers of species of these flies, particularly, it seems, on remote islands. Ideally, there should be perhaps a hundred collectors and workers scattered over the earth. Even among the best-known groups there is still much to discover. The museums contain only a small part of the existing species, and adequate collecting must be done by experts, who also must make the field observations. We soon find that our program is too vast to realize, but there is nothing to prevent the cooperative concentration of existing workers on some of these subjects. This does not imply any denial of individual responsibility and credit. Each worker should contribute his separate part and if this has to be incorporated in another's report it should be fully credited, if only to enable the reader to learn the source of his information. The greatest obstacle perhaps would be to find adequate means of publication, but this ought to be overcome.

Even in the absence of organized cooperation it is possible for numerous workers to interest themselves in particular groups, in particular parts of the world. It would be possible for certain journals or societies to announce that they would give preference to papers on these groups, and for museums to make special efforts to accumulate and arrange materials pertaining to them. Thus there would be no sort of domination or coercion, but only a concentration of interest in given directions.

Along with the kind of specialization described should go another, at right angles to it. Particular localities should be intensively studied, to determine the biological interrelations of all the organisms present. The Clare Island survey and the investigation of Plummer's Island on the Potomac show how richly this kind of investigation may be rewarded. This class of work equally requires cooperation, but also permits and even necessitates individual responsibility for the several contributions.

T. D. A. COCKERELL

UNIVERSITY OF COLORADO

THE DE REVOLUTIONIBUS ORBIUM COELESTIUM

LAST summer, being desirous to check up some statements regarding the famous work of Copernicus, I found that if I wished to consult the work I must do so in the original. Fortunately, the New York Public Library possesses a copy of "De Revolutionibus Orbium Coelestium," and I procured the volume and closely examined it. It is not a large book, containing only some two hundred pages and sixty thousand words. The ink seems as black and the thick, heavy paper as good as the day in 1543 when it issued from the press. The text proper starts out with one of those abstract "demonstrations" which are passed aside as "scholastic" if found in a medieval book, but bowed down to reverently when found in some Platonic dialogue. But, after leaving this "proof" of the cosmic significance of the circle, Copernicus begins to review the known astronomical facts of his time and to draw one conclusion after another towards establishing the thesis that the sun is the central pivot around which the planets revolve.

This part of the text has extreme interest. The Latin is very easy to read and, as far as I could judge, seems to be almost wholly of the classic type. The book is broken up conveniently in many small subdivisions. There are about forty geometrical diagrams. The really striking point about this ancient book, however, is its air of extraordinary freshness, due partly to the fact that, Copernicus' mathematical apparatus being limited to Euclid and Ptolemy's presentation of trigonometry, he uses many ingenious proofs where a modern astronomer would, no doubt, use a more powerful method. But the main reason for the striking quality of the book seems due to another fact: Copernicus was studying the heavens with his naked eyes. Any one had only to look up in the

skies on a clear night and if in possession of a few measuring instruments (without lenses, of course) could at once check and follow his reasoning.

As it seemed odd to me that no translation of this work existed in English, I queried two publishing houses in the matter, one the house of Putnam, which has brought out the books in the Loeb library, the other, the Harvard University Press. Messrs. G. P. Putnam's Sons wrote, August 19, 1925, through Mr. Ben Ray Redman:

> I have read with great interest your letter regarding the possible translation of Copernicus' "De Revolutionibus Orbium Coelestium" and regret to inform you that the publication of this work could not be undertaken at the present time with any hope of commercial success—at least by a general publishing house. If this epoch-making book has never before been translated into English, it seems to me that one of the university presses would be glad to bring it out and to secure for it the distribution which it deserves.

Some correspondence passed between the Harvard University Press and the present writer. Their attitude was most courteous, but on October 30, Mr. Harold Murdoch, director of the Syndics, wrote that on October 22 that Board had "regretfully decided that it would be unwise for us to attempt the publication."

It may be of interest to state that when this book was placed on the Catholic Index as a prohibited book (in 1616) a list was drawn up of the changes which might be made in the book to render it safe for the faithful to read. It is a curious and unintended eulogy of the scientific character of the book that, with the exception of the passages where Copernicus sums up his conclusions, little beyond verbal changes were needed elsewhere to make the work read as a hypothesis rather than a thesis. It is now beginning to appear that the motive for this condemnation was largely to exhibit the Catholic Church as quite as orthodox about the biblical cosmogony as the sectaries. Actually, of course, the obvious earth and heavens of the Old Testament are of far cruder type than either the conceptions of Ptolemy or Copernicus, but this was a fact which neither Catholics nor Protestants could well concede; and Copernicus' book remained forbidden till 1835, when it was silently removed from the Index Librorum Prohibitorum.

DREW BOND

MT. VERNON, N. Y.

A PLANT NEW TO THE UNITED STATES

WHILE visiting a beekeeper at Mesilla Park, New Mexico, in January, 1925, I was impressed with his description of a plant on which his bees worked freely. Being unable to decide what it might be from his description and no plants being available at that time of year, he promised specimens the following summer. When they came, I did not recognize the plant and passed it on to Dr. William Trelease, of the University of Illinois, for identification. Trelease was just leaving for an extended absence and again passed it on to Dr. Paul Standley, of the National Museum, who has specialized in flora of the southwest.

To the surprise of everybody interested he identified it as Syrian bean-caper, *Zygophyllum fabago,* which had not previously been known to occur in this country. From local reports the plant has become naturalized over a considerable area of the neighborhood in which it is found and is the source of considerable honey in the particular apiary which first brought it to attention. No one has so far offered any explanation of its presence.

FRANK C. PELLETT

HAMILTON, ILLINOIS

MILLING AND BAKING QUALITIES OF OLD WHEAT

A FARMER living near Junction City, Kansas, presented in August, 1925, to the Kansas State Agricultural College a sample of wheat which he knew to be at least twenty-five years old. The wheat was dark red, the kernels were plump, well preserved and there was no evidence of weevil. The test weight as received was 55.8, and after passing the cleaning separator it was 56.3. A germination test made in the seed-testing laboratory showed no signs of life. A milling test gave a normal amount of flour, but the ash was high. The amount of moisture and protein in both the wheat and flour compared well with the average generally obtained from a normal Kansas hard wheat. The baking test produced a loaf of small volume, heavy texture and poor color. The bread was very similar to that made from wheat which has been injured by heating in the stack or bin or when germination has proceeded too far. The gluten washed from the flour was also similar to that obtained when wheat has been injured as mentioned.

DR. C. O. SWANSON

DEPARTMENT OF MILLING INDUSTRY,
KANSAS STATE AGRICULTURAL COLLEGE

SCIENTIFIC BOOKS

Chemistry in Industry. In two volumes, edited by H. E. HOWE. *Chemistry in Agriculture.* In one volume, edited by JOSEPH S. CHAMBERLAIN and C. A. BROWNE. The Chemical Foundation Incorporated.

THE Chemical Foundation is an organization which has been described by A. Mitchell Palmer, former United States attorney general and alien property

custodian, in his report to Congress, and by Francis P. Garvan, alien property custodian, in an address to the National Cotton Manufacturers' Association, issued in pamphlet form in 1919.

The principal purpose of the formation of this corporation was to administer in a sane and useful way the various patents relating to the chemical industry which came into our hands as the result of the war with Germany, so that these patents could be used in a way to benefit American industry to the greatest extent possible. The following statement from Mr. Palmer's report is illuminating:

> These patents undoubtedly include the results of the research upon which must be based the manufacture of any new dyes which the Germans are now able to produce and market. Accordingly, at the very least, the institution will be able to protect the American industry for a considerable period, and this should be all it needs. It appears to be the universal view of the more competent manufacturers in this country that, given five years of freedom from German competition, the American industry can hold its own. Probably only a measure such as the embargo which appears to have been imposed by the British and French against all foreign dye importations can furnish this protection to the degree necessary to insure the safety of the American industry; but short of such an embargo, the Chemical Foundation would seem to furnish all the aid that possibly can be given.
>
> At the same time the new institution promises an incalculable benefit not only to the dye and chemical industries but to the whole American manufacturing world. The opportunities which it can offer and the rewards which it can hold out to competent research scientists should far exceed those of any institution unconnected with industry, and it may well, therefore, form the nucleus of the greatest research organization in the country.

In this same publication is contained the address of Francis P. Garvan, who followed Mr. A. Mitchell Palmer as alien property custodian. His address is entitled "The German Menace." At the close of Mr. Garvan's illuminating address, he says:

> Gentlemen, Drs. Albert and Bernstorff reported to their government that America could never establish the dye and pharmaceutical industry in this country, as we lacked the moral power for the creation of such an industry; that here each party pursued its own selfish interests, but nobody kept the whole in mind; that this problem could only be solved through regard for all points of view, and that the conflicting selfishness of this country rendered that solution impossible.
>
> The Chemical Foundation answers this statement with a challenge, and if it can only become the coordinating forum for American patriotism, American sacrifice and American ability, it awaits the issue with serenity.
>
> Gentlemen, we are the boys who stayed at home. True, the reasons seemed sound and sufficient yesterday. But to-day they seem only excuses, ever decreasingly satisfying. It is not enough that with envious tears we cheer their homecoming.
>
> Would they know our admiration, they must sit by our fireside and listen to us teach our children the character-building tales of their sacrifice. Would they know our love, they must lean over the cribs of those little ones and listen to the prayers of gratitude those little lips are lisping in their behalf. Would they know the depth of the realization of our obligations, and the strength of our resolve that they shall not have suffered and died in vain, we call upon their spirits to watch us in this fight. Peace, peace, and there is no peace!

The Chemical Foundation Incorporated is a Delaware corporation, capitalized at $500,000. The original trustees in whom, under the voting trust agreement, the control of the foundation was lodged are: Otto T. Barnard, Hon. George L. Ingraham, Cleveland H. Dodge, B. Howell Griswold, Jr., and Ralph Stone.

The original officers were: Francis P. Garvan, president; Col. Douglas I. McKay, vice-president; George J. Corbett, treasurer and secretary.

The offices of the foundation are at 55 Beaver Street, New York City.

The importance of chemistry to the industries is not a new discovery. Napoleon Bonaparte, while in exile at St. Helena, had as his surgeon and physician Dr. Barry E. O'Meara. Dr. O'Meara was an Irish doctor in the British army. He was delegated by the English authorities to accompany the former emperor to his island of exile and become his personal physician. He was so struck with the intellectual activities of his patient that he kept a complete diary in which each day the conversations he had with Napoleon were written down. On the 16th of July, 1816, he wrote the following:

> One of Leslie's pneumatic machines for making ice sent up to Longwood this day. As soon as it was put up, I went and informed Napoleon, and told him that the admiral was at Longwood. He asked several questions about the process, and it was evident that he was perfectly acquainted with the principles upon which air-pumps are formed. He expressed great admiration for the science of chemistry, spoke of the great improvements which had latterly been made in it, and observed that he had always promoted and encouraged it to the best of his power. I then left him and proceeded to the room where the machine was, in order to commence the experiment in the presence of the admiral. In a few minutes Napoleon, accompanied by Count Montholon, came in and accosted the admiral in a very pleasant manner, seemingly gratified to see him. A cup full of water was then frozen in his presence in about fifteen minutes, and he

waited for upwards of half an hour to see if the same quantity of lemonade would freeze, which did not succeed. Milk was then tried, but it would not answer. Napoleon took in his hand the piece of ice produced from the water, and observed to me what a gratification that would have been in Egypt. The first ice ever seen in St. Helena was made by this machine, and was viewed with no small degree of surprise by the *yam stocks* (a cant name for the natives of the island), some of whom could with difficulty be persuaded that the solid lump in their hands was really composed of water and were not fully convinced until they had witnessed its liquefaction.

In December, 1816, Dr. O'Meara had another conversation with Napoleon in which the science of chemistry was mentioned. He was discussing the European embargo which was established in England in order to deprive France of any trading with a distant world. Speaking of the English command of the sea, he said:

"But your ministers have had false ideas of things. They imagined that they could inundate the continent with your merchandise, and find a ready sale. No, no: the world is now more illuminated. Even the Russians will say, 'Why should we enrich this nation, to enable her to keep up a monopoly and tyranny of the seas, while our own manufacturers are numerous and skilful?' You will," continued he, "find that in a few years very little English merchandise will be sold on the continent. I gave a new era to manufactories. The French already excel you in the manufacture of cloths and many other articles. The Hollanders in cambric and linen; I established the *École Polytechnique*, from which hundreds of able chemists went to the different manufactories. In each of them I caused a person well skilled in chemistry to reside. In consequence, everything proceeded upon certain and established principles; and they had a reason to give for every part of their operations instead of the old vague and uncertain mode. Times are changed," continued Napoleon; "and you must no longer look to the continent for the disposal of your manufactures. America, the Spanish and Portuguese main, are the only vent for them. Recollect what I say to you. In a year or two your people will complain, and say, 'We have gained everything, but we are starving: we are worse than we were during the war.' Then, perhaps, your ministers will endeavor to effect what they ought to have done at first. You are not able," he continued, "to face even Prussia in the field, and your preponderance on the continent was entirely owing to your naval sovereignty; England has played for all or for nothing. She has gained all, effected impossibilities, yet has nothing; and her people are starving and worse than they were during the midst of the war; while France, who has lost everything, is doing well, and the wants of her people are abundantly supplied. France has got fat, notwithstanding the liberal bleedings which she has had; while England is like a man who has had a false momentary strength given him by intoxicating liquors, but who, after their effect, sinks into a state of debility."

I do not know that I can say anything in addition to the value of chemistry in industry to what Napoleon, in this memorable interview, has described.

These three books mentioned above are simply evidence of the fulfilment of the vision of Napoleon Bonaparte. These books are written by a corps of experts. In the first volume the following industries are listed:

"Abrasives," by F. J. Tone, president of the Carborundum Co.

"Alcohol and Some Other Solvents," by D. B. Keyes, U. S. Industrial Alcohol Co.

"Coal, Coke and Their Products," by F. W. Sperr, Jr., chief chemist, The Koppers Co.

"Cotton and Cotton Products," by Thomas C. Law.

"Chemistry in the Electrical Industry," by Buckner Speed, Western Electric Co.

"Some Applications of Electrochemistry," by A. H. Hooker.

"Chemistry in the Fertilizer Industry," by R. B. Deemer.

"Industrial Gases," by Clark S. Robinson.

"Glass, One of Man's Blessings," by Alexander Silverman.

"The Elements of Iron and Steel Manufacture," by A. E. White.

"The Making of Leather," by John Arthur Wilson.

"Nonferrous Metallurgy," by H. W. Gillett.

"Chemistry of Packinghouse Processes," by W. D. Richardson.

"Chemistry in Pulp and Paper Industry," by Maximilian A. Krimmel.

"Perfumes and Flavors," by S. Isermann.

"The Petroleum Industry," by Gerald L. Wendt.

"Photography," by S. E. Sheppard.

"Synthetic Resin," by A. V. H. Mory.

"Chemistry in the Rubber Industry," by W. J. Kelly.

"Chemistry in the Textile Industry," by L. A. Olney.

In the second volume, the following monographs occur:

"Catalysis," by Ellwood Hendrick.

"The Chemist's Contributions to Aviation," by C. W. Seibel.

"Casein," by George H. Brother.

"The Chemical Rainbow," by M. L. Crossley.

"Chemistry and its Application to the Confectionery Industry," by Stroud Jordan.

"Earthenware and Porcelain," by Albert V. Bleininger.

"The Chemistry behind Electric Batteries," by Homer D. Holler.

"Electroplating and Electroforming," by W. Blum.

"Military and Industrial Explosives," by Charles L. Reese.

"Glues and Gelatins," by R. H. Bogue.

"The Chemistry of Inks," by A. B. Davis.

"Lubricants," by William F. Parish.

"Matches," by Hugo Schapiro.

"Paints, Varnishes and Colors," by Henry A. Gardner.
"Portland Cement," by G. A. Rankin.
"Chemistry, Radio and Incandescent Lamps," by Mary R. Andrews.
"Railroad Chemistry," by William M. Barr.
"Rayon, Man-Made Silk," by M. G. Luft.
"Chemistry in Refrigeration," by Frederick G. Keyes.
"Rust-Resisting Metals," by F. M. Becket.
"Soap," by Martin Hill Ittner.
"The Relation of Chemistry to Water Supplies," by W. W. Skinner.

In the third volume, "Chemistry in Agriculture," we find the following monographs:

"Crops and the Soil," by R. W. Thatcher.
"The World's Food Factory," by John M. Arthur and Henry W. Popp.
"Soil Life," by Jacob G. Lipman.
"Where the Nitrogen comes from," by Harry A. Curtis.
"Maintaining Soil Fertility," by G. S. Fraps.
"Cereals," by C. H. Bailey.
"Sugar and Sugar Crops," by C. A. Browne.
"Fruit and Vegetables," by E. M. Chace.
"Fermentations of the Farm," by J. J. Willaman.
"Chemical Warfare to save the Crops," by Andrew J. Patten.
"Agriculture and the Evolution of our Diet," by C. F. Langworthy.
"Vitamins in Human and Animal Nutrition," by R. Adams Dutcher.
"Meat in its Relation to Human Nutrition and Agriculture," by C. Robert Moulton.
"Chemistry as a Guide in Animal Production," by E. B. Forbes.
"The Chemistry of Milk and its Products," by L. L. Van Slyke.
"The Chemist as Detective and Policeman," by B. B. Ross.

In the above list one of the monographs on chemistry in refrigeration is on the very subject which led Napoleon to the luminous description of the value of chemistry in industries. Another one of them, however, is a discussion of fermentations on the farm and, you might add, in the home which is now very much in the limelight in the hearings on prohibition before the Senate committee. One would think that the list was full, but there is yet much to be done before we have a complete chemistry in the form of monographs of all the industries in which chemistry is the leading science. That means practically all.

I have no time here to enter into any particular discussion of any of these monographs. The high standing of the authors, being experts in the very industries about which they write, is a guarantee of the character of this addition to our industrial literature. Expert editorial control of a high order has secured a fair degree of unity of style.

The chemist, of course, has no intention of assuming that chemistry is the only science in industry, but I believe he will be able to maintain, without any serious challenge, that there is no other one science so important in industry as chemistry. Imagine for a moment the condition of our industries if all chemical control were suddenly withdrawn, with no possibility of ever having it restored. An environment of complete paralysis would soon ensue. There would be no further progress in methods of research and of commercial treatment of articles.

In the one industry of pharmacy, I was told recently at Indianapolis, where I was addressing a luncheon of chemists of that city, that Eli Lilly and Company alone employed forty chemists in their research laboratories, and this is only one of the great manufacturing drug firms in this country.

The American Chemical Society now has sixteen thousand members, and there are still many practicing chemists who are not members. If I should say that the total number of persons engaged in chemistry in one way or another in this country was close to twenty thousand, I would not be far from the truth. There is no industry of any kind now extant and flourishing in our country that is not in some way or another connected with direct chemical control. The progress of our industries in extent and in economy is more dependent upon the work of the chemists than of any other group of men. This is fully recognized now by the great captains of industry. When the American Chemical Society celebrated its twenty-fifth anniversary, I had the honor to be the orator of the occasion and took for my subject "The Dignity of Chemistry." I called attention to the fact that too often the chemist was regarded as the hewer of wood and the bearer of water; that he had not attained the dignity in industrial life which was his due. Another twenty-five years have now passed and we see a great change in the standing of the chemist. He has attained his due dignity.

H. W. WILEY
WASHINGTON, D. C.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

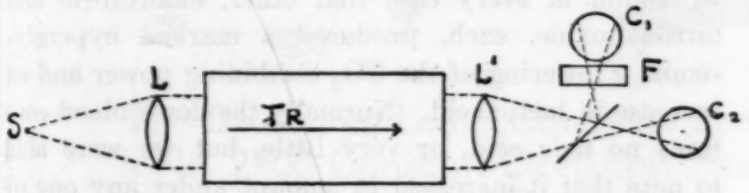
THE USE OF ARCS AND OTHER FLUCTUATING SOURCES IN PHOTO-ELECTRIC PHOTOMETRY

IN his paper on the registering microphotometer P. P. Koch[1] describes an arrangement consisting of

[1] P. P. Koch, *Annalen der Physik*, IV, 39, p. 705 (1912).

two similar photoelectric cells connected to an electrometer, both illuminated by the same source, but through different optical paths. The arrangement described has the advantage of being independent of intensity fluctuations in the source (provided that these are uniform over the area of the source), since the electrometer reading depends only upon the *ratio* of the intensities falling on the two cells. An example is given in which a change from 10 to 100 in the light intensity of the source produced only a one per cent. change in the electrometer deflection. However, it remained impossible to use arcs, or other light sources which not only fluctuate in intensity, but also flicker or change their position; for since the two beams come from different parts of the source, and traverse different optical paths, flickering changes the ratio of their intensities as well as the absolute values.

It is the purpose of this note to point out that in most cases the optical paths to the two cells may be made practically identical by using a partially reflecting plane mirror to divide the beam. The arrangement is shown in the accompanying figure:



S is the source (a carbon or mercury arc, for example); L and L′ are lenses whose purpose is obvious; TR represents an optical train of any kind (lenses, prisms, filters, polarizers, etc.); M is the partially reflecting plane mirror, C_1 and C_2 the two similar cells, and, before C_1, F, the filters, photographic plates, crystals, analyzing nicols, etc., whose variable transmission or absorption it is desired to measure. (The electrical connections of the cells, and the electrometer, etc., are not shown: they are described in detail by Koch, *l. c.*). Under these conditions flickering and wandering of the light source will alter both intensities in the same ratio, provided that the variable absorber F takes the full beam of light, *i.e.*, requires no further diaphragms. This will be true, for instance, in measuring the absorption of filters, large crystals, large areas of a photographic plate, etc.

If the variable absorber F requires a diaphragm, troubles may arise due to the fact that fluctuations may change the distribution of energy over the cross-section of the beam of light. The intensity of the beam diaphragmed out may then change, whereas that of the full beam going to C_2 does not. There are then two alternatives: if the diaphragm in F may be removed some distance from the absorber, the dividing mirror M may be placed between the diaphragm and the absorber. But if, as in the microphotometry of spectral lines, the diaphragm must be very close to the object whose transmission is to be measured, an attempt must be made to diaphragm the beam going to C_2 in an exactly similar manner, so that the two diaphragms or slits are situated at corresponding points of the cross-sections of the beams (which, fortunately, are themselves similar). How well this compensation will succeed depends on the fineness of the slits, on the optical system and on the constancy of the light source.

The proper ratio for the intensities of the two beams is determined by the experimental conditions. It can be altered at will by interposing a uniform filter before either cell. One must, of course, take precautions to ensure that the variations in the intensity of the source are not too great. From Koch's data and from results obtained in testing the present modification, variations of even several hundred per cent. are permissible.

Thus it is possible to use arcs and similar light sources giving high intensity in all regions of the spectrum for a large number of problems involving photoelectric photometry.

B. KURRELMEYER

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SPECIAL ARTICLES

QUARTET AND DOUBLET TERMS IN THE COPPER SPECTRUM

THE theory of the relation of electron configurations to spectral terms developed by F. Hund[1] when applied to the copper atom yields the following results. The lowest term of the spark spectrum which arises from ten d-electrons should be a ^1S and the addition of one electron should give a doublet spectrum of ordinary type. This spectrum is known. The next higher terms of the spark arise from nine d-electrons and one s-electron and are ^3D and ^1D. These, by the addition of a further s-electron, give terms ^4D, ^2D and ^2D which merge in the lowest state into ^2D alone. This term is $^2D_3 = 51105.5$ and $^2D_2$ 49062.6 and is discussed in my paper in *Phil. Mag.*, Vol. 49, p. 951, 1925. The addition of a p-electron to the spark ^3D and ^1D should result in low terms ^4P, $^4D'$, ^4F, ^2P, $^2D'$, ^2F and a second higher set ^2P, $^2D'$, ^2F. Such terms have now been found. Their values are:

[1] *Zs. f. Phys.*, 33, 345, 1925.

$^4P_1$	21364.3	$^4F_2$	20005.5	$^4D_1'$	17392.3
$^4P_2$	22194.0	$^4F_3$	20745.2	$^4D_2'$	17763.9
$^4P_3$	23289.4	$^4F_4$	21154.7	$^4D_3'$	17901.8
		$^4F_5$	21398.9	$^4D_4'$	18794.1
$^2P_1$	16487.2	$^2F_3$	18581.9	$^2D_2'$	16135.2
$^2P_2$	16428.8	$^2F_4$	17344.8	$^2D_3'$	15709.7

The quartet terms combine with the high ^4D term mentioned above, arising from the ^3D of the spark and give strong multiplets in the visible. They are analogous to the visible multiplets of highest multiplicity in the spectra of iron cobalt and nickel.

The following is the ^4F ^4D multiplet of this group. Wave numbers and intensities only are given.

	$^4F_5$	$^4F_4$	$^4F_3$	$^4F_2$
	21398.9	21154.7	20745.2	20005.5
$^4D_4$				
— 95.2	21494.1(8)	21249.9(6)	20840.4(2)	
$^4D_3$				
— 640.2		21794.8(6u)	21385.5(2u)	20645.9(1u)
$^4D_2$				
—1276.4			22021.7(4u)	21282.0(2u)
$^4D_1$				
—2164.2				22169.7(4)

It will be noticed that the ^4D term is negative and that all the lines arising from $^4D_2$ and $^4D_3$ are diffuse. This is a peculiar characteristic of these two terms in all three multiplets.

In addition to the low terms given above there are eleven further terms which combine with ^2S and ^2D. They probably include the set ^2P, $^2D'$, ^2F, which arise from the ^1D spark term as well as terms arising from ^3F of the spark.

A set of thirty-five negative terms has been found from combinations with the low quartet and doublet terms. They account for some three hundred further lines, including practically every strong line in the spectrum as well as most of the weak lines above λ 2900. These negative terms should include the higher members of the two series which commence with the low ^2D term and which have as limits the ^1D and ^3D spark terms; but as yet it has not been found possible to pick out such terms with certainty.

As would be expected from the atomic structure which gives rise to this spectrum, it has many characteristics of a spectrum of the second rank, including g-values not at all in accordance with the Lande g's.

The structure of the copper spectrum here given is in complete disagreement with the analysis given by H. Stucklen.[2] A detailed discussion of the spectrum, including Zeeman effects and other evidence, will be published in the near future.

A. G. SHENSTONE

DEPARTMENT OF PHYSICS,
PRINCETON UNIVERSITY

[2] *Zs. f. Phys.*, 34, 562, 1925.

BLOOD STUDIES IN GENERAL ANESTHESIA[1]

IN a previous communication we showed that eclampsia is associated with the following changes in blood constituents: a high uric acid, an increased lactic acid, a decrease in the CO_2 combining power and a definite tendency towards a hyperglycemia, which is often associated with a high inorganic phosphorus. We have tried to reproduce this blood picture in dogs by the use of anesthesia. Thus far we have worked with ether, chloroform, nitrous oxide and ethylene. Blood specimens were obtained before the administration of the anesthetic, the animals were then anesthetized for half an hour and additional blood samples were withdrawn at regular intervals.

The blood samples were analyzed for sugar, lactic acid, uric acid, inorganic phosphorus, non-protein nitrogen, urea nitrogen and CO_2 combining power, and we found in every case that ether, chloroform and nitrous oxide, each, produced a marked hyperglycemia, a lowering of the CO_2 combining power and an increase in lactic acid. Normally the dog's blood contains no uric acid, or very little, but we were able to note that it increased in amount under any one of the three anesthetics. The inorganic phosphorus seems to follow the sugar curve. The non-protein nitrogen and the urea nitrogen showed only minimal changes from normal. In other words, we found changes practically identical with those observed in eclampsia.

With ethylene gas the blood changes are the same as with the other anesthetics, except that they are not nearly so marked. Our findings seem to indicate that in all the general anesthetics we have to deal with a single fundamental picture. We are aware that anoxemia may produce somewhat similar changes, but further work in asphyxia and its prevention in general anesthesia, as well as in the use of insulin following the administration of anesthesia, leads us to believe that at most asphyxia plays only a small part in the production of the profound changes in the blood here reported.

A full description of this work, with the necessary protocols, will appear in the near future in the *American Journal of Obstetrics and Gynecology*.

H. J. STANDER
A. H. RADELET

[1] From the Department of Obstetrics, Johns Hopkins Hospital and University.

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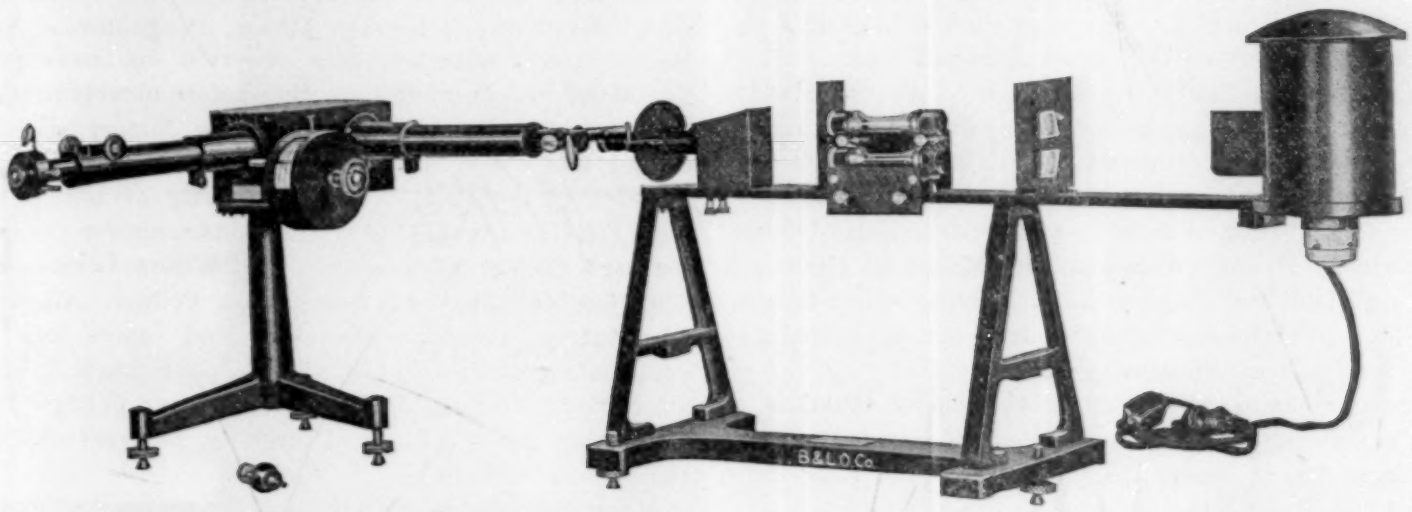

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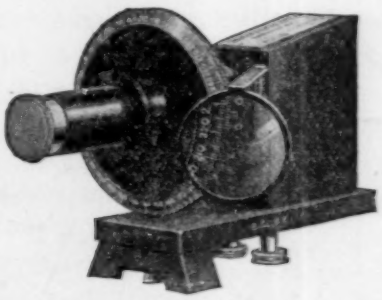

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SCIENTIFIC PROGRESS DURING 1925

Agriculture

Chemical analysis of the cotton plant, and discovery that trimethylamine is the odorous substance that attracts the boll weevil, was reported by scientists of the United States Department of Agriculture.

Anthropology

A prehistoric skull, which may be another link in the chain of human evolution, was found at Taungs in South Africa. It is said to be older than the ape man of Java and half way between the higher apes and man.

Excavations in Florida revealed human remains closely associated with the bones of mammoth under circumstances thought to indicate that prehistoric elephants survived in America longer than previously supposed.

The Gobi Desert expedition of the American Museum of Natural History discovered in Mongolia abundant traces of Old Stone Age culture. Among other things, they learned that ancient man made ornaments out of the still more ancient dinosaur eggs.

Human remains of prehistoric times were found in a cave in Crimea together with skeletons of mammoths, cave hyenas and cave bears, characteristic of the later days of the Old Stone Age.

The skull of a hitherto unknown race of the Neanderthal type of ancient cave men was discovered near Capernaum in Galilee.

A French-American expedition explored northern Africa and found evidences of prehistoric men similar to those of southern Europe.

Dr. Edward Sapir, Canadian anthropologist, announced that he had discovered striking resemblances between American Indian dialects and the ancient Chinese language.

Ten prehistoric stone tombs containing valuable relics were unearthed from an ancient Indian mound near Cartersville, Georgia.

A hoard of valuable pearls was discovered in a prehistoric Indian mound in Ohio.

Archeology

An expedition to excavate Armageddon, famous ancient battleground in central Palestine, was organized by the Oriental Museum of the University of Chicago.

The Russian Geographical Society's expedition to Tibet returned with an extensive collection of ancient relics, some of which indicate that 2,000 years ago a Mongolian civilization flourished which had contact with Hellenic culture.

The antiquity of the Phoenician alphabet was set back from 850 B. C. to the fifteenth century B. C. by discovery of old inscriptions.

Astronomy

The total eclipse of the sun on January 24, 1925, was found by Professor Ernest W. Brown, of Yale University, to have been four seconds late, due partly to uncertainty as to the moon's actual position in space.

The puzzling shadow bands which appear before and after total eclipses of the sun were traced to rising warm air currents by Dr. Charles Clayton Wylie, of Iowa University.

Studies based on this eclipse showed that the sun's corona is approximately 5,000 degrees Fahrenheit, or only half as hot as earlier calculations had indicated.

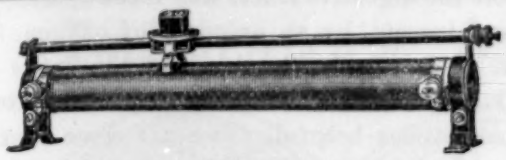
The total eclipse of the sun, which was visible along a path from Buffalo, through Ithaca, Poughkeepsie, New Haven and Nantucket, was observed by more than 20,000,000 people, more than ever before observed such a phenomenon. For the first time in history such an eclipse was observed from a dirigible balloon, the *Los Angeles*, of the U. S. Navy, by a party of astronomers from the U. S. Naval Observatory. Astronomers from the Harvard College Observatory, Mt. Wilson Observatory, Sproul Observatory of Swarthmore College, Allegheny Observatory, Lowell Observatory and others went to points along the path of totality to photograph it, while astronomers at Cornell University, Vassar College, Yale University and Wesleyan University observed it from their own observatories.

Many spectrum lines, indicating the presence of oxygen and other chemical elements, were photographed at the eclipse for the first time by Dr. H. D. Curtis, of the Allegheny Observatory at Pittsburgh. These photographs were of the flash spectrum, which can be seen just before and after a total eclipse, and of the corona, which is seen during totality. They were made by red and infra red light.

Astronomers from the Naval Observatory at Washington, the Sproul Observatory at Swarthmore College, the Allegheny Observatory at Pittsburgh, the Mt. Wilson Observatory in California, Harvard University, the U. S. Bureau of Standards and institutions in Europe, sailed for Sumatra to prepare for the observation of a total eclipse of the sun which will be seen there on January 14, 1926.

Photographs made by Dr. Edwin P. Hubble, of the Mt. Wilson Observatory, California, with the great 100-inch telescope showed that the spiral nebulae, and certain irregular nebulae, consisted of great swarms of stars at vast distances. The nearest are so far away that their light takes about a million years to reach us, and they were therefore shown to be "island universes," similar to our own stellar system of which the sun and the other stars in the Milky Way and also those seen in other parts of the sky are parts.

Eleven comets, an unprecedented number for one year, were discovered; two by American astronomers, Professor George Van Biesbroeck, of the Yerkes Observatory, and Leslie C. Peltier, an amateur of Delphos, Ohio; two others by amateur astronomers in South Africa and two in Russia. Some of the eleven were old friends returning on



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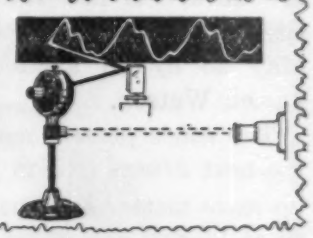

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one of their periodic visits, while others were new ones. A "nova," or new star, was discovered in the constellation of Pictor, the "Painter," in the southern skies on May 25 by an amateur astronomer in South Africa, named Watson.

The sun's present mass will supply light and heat for the next fifteen trillion years, and, as the sun may gather up more matter as it passes among the stars, it may continue longer, according to reports made to the American Mathematical Society. Study of sunspots in relation to weather continued, and Dr. H. H. Clayton, former head of the forecasting department of the Argentine Weather Service, predicted that other nations would follow Argentina's example in applying observations of solar radiation to forecasting.

The craters on the moon were caused by the explosions of millions of meteors, after hitting the moon with a speed as high as 50 miles a second, according to a new theory proposed by A. C. Gifford, of New Zealand. The theory that the moon is made of material that was once part of the earth's crust and that was peeled off by attraction of the sun was advanced by Dr. R. H. Rastall, at Cambridge University.

A branch of the Harvard College Observatory was established in the nitrate desert of northern Chile, the highest driest desert in the world, to aid in the observation of stars too far south to be seen from Cambridge. A branch of the Yale University Observatory was established in South Africa with the completion of a 26-inch refracting telescope. This observatory will supplement the work done at New Haven, Conn., by Dr. Frank Schlesinger, director of the observatory, in finding the distances of the stars.

Aviation and Aeronautics

The U. S. dirigible *Shenandoah* was wrecked by a storm in Ohio, with great loss of life.

An attempt was made by U. S. airplanes to fly to the Hawaiian Islands, but it was not successful.

A new type of airplane, the autogiro, invented in Spain, was tested and praised by the British Air Ministry. It obtains its lift in part by large propeller-like rotating wings.

Biology

A chemical test by which the sex of plants or animals can be determined from a few drops of plant juices or blood was worked out in Russia and applied by scientists of the Carnegie Institution of Washington.

Evidence that a severed optic nerve can reunite and at least partially recover its function was obtained by study of rats at the University of Chicago.

The pituitary gland was completely removed from dogs by surgeons of Johns Hopkins Hospital without killing the animals, an operation previously considered as productive of certain death.

Star-fish and sea urchins were developed from unfertilized eggs at the University of Chicago with only ultraviolet light for a father.

Silkworms were successfully vaccinated against a bacterial disease by Dr. R. W. Glaser, of the Rockefeller Institute for Medical Research.

A new method of killing protozoa, the minute animals that inhabit the digestive tracts and blood systems of man, animals and insects, by an overdose of oxygen, has been discovered by Dr. L. R. Cleveland, of the Johns Hopkins University. While these minute animals are often harmless and sometimes helpful, there are some that are the cause of such diseases as malaria, sleeping sickness and dysentery.

Success in preserving the last herds of American bison from extinction was reported from Canada.

For the first time, male sex glands were successfully transplanted in animals and made to persist in normal condition.

A scientific survey of America's fresh water food resources was inaugurated by the National Research Council.

Chemistry

Mercury was transmuted into gold. Professor A. Miethe, of the Berlin Technical High School, found that mercury vapor lamps became obscured after long usage by a sooty substance which on analysis proved to be partly gold. Artificial production of gold from mercury by the application of strong electrical forces was also announced by Professor Nagaoka, of Tokyo.

Dutch scientists claimed to have transmuted lead into mercury and thallium.

Methods of reclaiming old automobile oil were reported by several investigators.

Vitamin C, the preventive of scurvy, was obtained for the first time concentrated into crystalline form.

Two missing chemical elements, numbers 43 and 75, were discovered by means of spectra obtained by passing a beam of X-rays through concentrated solutions of rare minerals. Dr. Walter Noddack, of Berlin, the discoverer, named them masurium and rhenium.

Production of methanol, or wood alcohol, from coal was invented and developed in Germany. Experiments with this German synthetic methanol, at the Harvard Medical School, showed it to be as poisonous as wood or methyl alcohol.

A new process by which "pure" aluminum—containing less than two one hundredths of one per cent. of impurity—can be made commercially, was reported.

Rare elements, such as lithium, vanadium and nickel, were found in petroleum ash in quantities sufficient to warrant their extraction from the ashes of petroleum cokes and to be used as future sources of these substances.

Evolution

The state of Tennessee passed a law forbidding the teaching of evolution in public schools and universities. The testing of this law, by the trial of John T. Scopes of Dayton, Tennessee, in July, was one of the most dramatic events of the year. The verdict of the lower court was conviction. The constitutionality of the law will be tested before the Supreme Court of the state in January, 1926.

Life existed on the earth when the oldest known rocks were formed. Dr. John W. Gruner, of the University of Minnesota, found fossil remains of blue-green algae

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Archaean rocks which were once believed to have been formed by the direct cooling of a molten earth.

The biggest lot of dinosaur bones ever found in one place was unearthed in Tanganyika, formerly German East Africa.

Chemical affinities between the blood of apes and man, much closer than that between the tailed monkeys and man, was shown by serological tests at the Rockefeller Institute.

Evidence of the process of evolution actively going on was discovered in snails of the South Seas. The divergencies shown did not produce distinct species, but the existence of divergent individuals of adult growth showed "that mutation is a real and contemporaneous process."

Geography

The *Maud*, Captain Amundsen's ship, returned after three years of drifting in Arctic ice and Dr. Harald Sverdrup reported tidal observations that indicate there is no land in the unexplored Arctic area.

A great submarine current which runs from the North Atlantic and comes to the surface again 2,000 miles south of the equator was discovered by the German ship, *Meteor*.

Experiments to see whether ships could detect hidden icebergs by the sonic depth recorder were made by U. S. Coast Guard cutters.

Perfection of a new sounding device especially designed for speedy mapping of the ocean floor by means of echoes from the sea bottom was announced.

Geology

The City of Santa Barbara, California, was badly damaged by a heavy earthquake in June; another earthquake shook Montana and neighboring states at the same time. New England and eastern Canada were shaken by an earthquake on February 28.

The U. S. Coast and Geodetic Survey, the Jesuit Seismological Association and Science Service of Washington, cooperating with seismological observatories in the United States and foreign countries, have perfected a method of quickly and accurately locating the epicenters, or points of greatest motion, of earthquakes.

Foot prints of animals that lived twenty-five million years ago were found in primitive rocks 950 feet below the top of the Grand Canyon of the Colorado River. They are believed to have been crustaceans and amphibians.

Rich deposits of platinum have been found in the Transvaal.

Inventions

A boiler in which the flame burns in direct contact with water, thereby eliminating much of the heat loss common in other boilers, was invented by a Belgian scientist.

An airplane gasoline tank which can be completely riddled by explosive bullets without bursting into flames or leaking was developed in Vienna.

A system of musical stenography by which the full orchestrated score can be taken down as it is played was devised by M. Henry Raymond in Switzerland.

The rotor ship, which uses wind power by means of rotating cylinders instead of by sails, was invented in Germany by Dr. Flettner.

C. Francis Jenkins, of Washington, D. C., reported that he had successfully sent moving pictures by radio from one room of his laboratory to another and that long range radio movies had been proved practicable.

Synthetic "wopl" was commercially produced from wood by processing similar to that used in making rayon or artificial silk.

A gas mask effective against all poisonous gases, provided they are not too strongly concentrated, was developed by the U. S. Bureau of Mines.

Medicine and Physiology

The use of delicate electric needles to replace the surgeon's knife and render surgery less painful and dangerous was announced by Dr. Howard A. Kelly, of Johns Hopkins University.

A new chemical substance composed partly of arsenic and bismuth was found effective in the treatment of syphilis by scientists of the Pasteur Institute in Paris.

Successful use of radium in the treatment of leprosy was reported by the Kalihi Leper Receiving Hospital at Honolulu.

Eggs from hens deprived of sunlight were found to lack vitamin which prevents rickets in children, while the eggs of hens receiving sunlight had this important food factor.

Eggs do not have to be fresh to retain their vitamins, because nine-year-old eggs were still found rich in vitamin A, in experiments conducted by the U. S. Bureau of Chemistry.

The parathyroid gland, one of the ductless glands situated in the throat in the region of the Adam's apple, secretes a hormone that prevents tetany, a condition of spasms and stiffening of the muscles.

A new dietary factor that prevents pellagra has been found in fresh milk, brewers' yeast and fresh beef, by scientists of the U. S. Public Health Service.

(To be continued.)

ITEMS

A CAREFUL analysis of cancer statistics gathered by the U. S. Census Bureau over a period of about twenty years in ten Eastern states reveals definitely that cancer mortality is from 25 to 30 per cent. higher than it was about twenty years ago. This is the claim of Dr. J. W. Schereschewsky, of the U. S. Public Health Service, who made the statistical analysis and reported it to the American Medical Association. "There has been a pronounced increase in the observed death rate from cancer in persons forty years old and over in the ten states comprising the original death registration area," Dr. Schereschewsky said. "Part of this increase is due to greater precision and accuracy in the filling out of death returns, but the remainder is an actual increase in the mortality of the disease."

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SCIENTIFIC PROGRESS DURING 1925

(Continued)

Medicine

The causal organism of one type of cancer was isolated and photographed by means of the ultramicroscope, according to the claim of English workers.

The germ which causes distemper in dogs was discovered by Professor Robert C. Green, of the University of Minnesota.

Certain soil bacteria were found to have the same effect on plant growth as vitamins have on animal growth, by Dr. Florence A. Mockeridge, of Swansea, England.

A vaccine made from infected cattle ticks was found an effective protection against Rocky Mountain spotted fever.

Chicago bacteriologist found bacteria living in oil wells more than 1,000 feet deep. This is a record depth for living organisms on land.

Hoof and mouth disease of cattle was fought in Denmark with serum treatment instead of by slaughtering the herds.

Dr. A. Besredka, a Russian scientist working at the Pasteur Institute in Paris, discovered that deadly germs may be entirely harmless if planted in tissue on which they are not accustomed to prey.

An extract obtained from the liver of animals was found to be effective in lowering high blood pressure of human subjects and may prove to be as effective in its field as insulin is in treating diabetes.

Extract from the parathyroid glands was found to be useful in speeding up the healing of broken bones.

The causative organism of sleeping sickness, encephalitis lethargica, was, according to claims, identified as a minute filter passing organism.

A new synthetic substitute for cocaine which can be used as a local anesthetic, has been discovered in Germany. It was named "totokain" and is prepared from some of the intermediate products in the manufacture of artificial rubber.

The thymus gland, an obscure ductless gland in the neck, was found to have influence on egg production in the case of pigeons.

Rats from which the thyroid gland has been removed, and which were suffering from cretinism as a result, were made to grow normally again by extra doses of pituitary extract.

Propylene, a gas closely related to ethylene, was found to possess important anesthetic powers.

Vitamin E, the presence of which in foods is necessary for reproduction of offspring, was shown to be present in a large variety of vegetable and animal substances.

A process of quantitatively measuring the flow of the blood, sought for during the past two centuries, was discovered at Yale University.

The League of Nations established the broadcasting of health reports from a radio station in French Indo-China, so that countries of the world might be kept informed of disease conditions, and warned of alarming changes in the plague areas of the Far East.

Complications from scarlet fever, such as inflammation of the joints, infections of the ear, nose and throat, can be avoided by early use of the antitoxin perfected by Dr. G. F. Dick and Dr. Abraham Zingher, according to reports made by them.

Milk, olive oil and some other foods which had been exposed to ultra-violet light were found to have the same curative effects on children suffering from rickets as doses of cod-liver oil or exposure of the patients themselves to ultra-violet rays.

Researches at the Carnegie Institution's Department of Genetics showed that determination of sex must be considered from a physiological, chemical and biological standpiont, and that changes in the rate of living of the organism may be even more fundamental in determining sex than the make up of the cell itself.

A new and powerful antiseptic, derived from the coal-tar product resorcinol and called "hexyl-resorcinol," was made by Dr. Veader Leonard, of Johns Hopkins.

A new X-ray machine, in which the photographic plate is exposed only when the heart is quiet between beats, made it possible to take clearer X-ray pictures of conditions in the lungs, was developed at the University of Pennsylvania.

A new cure for hookworm, as effective as carbon tetrachloride, was discovered by Drs. Maurice C. Hall and J. F. Shillinger, of the U. S. Department of Agriculture.

Physics

Penetrating radiation of cosmic origin was discovered by Dr. R. A. Millikan to be made up of "ultra X-rays" a thousand times shorter than the shorter and hitherto most powerful rays known. It is believed they are evidences of the formation of matter throughout all space.

Cathode rays, shot through a metallic window in a vacuum tube, were found to kill bacteria and insects and produce other striking physiological and physical effects.

Professor Gilbert N. Lewis announced a new theory of radiation based on the Einstein view of time, which makes a distant star and the eye-ball of an observer come into virtual contact.

A method for making sheets of steel so thin that they could be seen through like glass was invented by Dr. Karl Mueller, of Berlin.

Hafnium, one of the latest discovered chemical elements, has been found to be of practical value in the making of filaments in electric lights.

An ether drift experiment, by Professors A. A. Michelson and H. G. Gale, of the University of Chicago, in which the speed of two beams of light, one traveling east and the other west, when compared, indicated that the ether is not appreciably dragged along with the earth in its rotation, confirming Einstein's theory.

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Evidence of ether drift, contrary to the famous Michelson-Morley experiment basic to the Einstein theory, was obtained by Professor Dayton C. Miller, who set up an interferometer on Mt. Wilson, 5,000 feet above sea level, and found positive displacement of fringes when beams of light conflicted. This is said by some authorities to overthrow the theory of relativity.

Measurements of the displacements of the dark lines in the faint companion star Sirius, the "dog star," made at the Mt. Wilson Observatory in California, show close agreement with the predictions of Einstein and of Professor Eddington, of Cambridge University in England, and indicate that the star is so dense that if a pint of it could be brought to the earth it would weight twenty-five tons.

EXPERIMENTS ON CANCER

A CABLEGRAM from Dr. W. E. Gye, of London, whose cancer experiments are attracting great interest among doctors and the public, was read at a special meeting of the Baltimore City Medical Society. The message indicated that the delicate tests, which led to startling reports of a cancer microorganism being seen and cultivated, are being repeated in efforts to confirm or disprove the results.

The cable, which was read by Dr. George A. Soper, managing director of the American Society for the Control of Cancer, was a reply to his letter asking Drs. Gye and Barnard whether their experiments are being confirmed.

Dr. Soper, who spent three months in Europe recently, investigating cancer research work, stressed the point that such difficult experiments as the work of Gye and Barnard, and the use of lead injections in the treatment of cancer, as reported on by Dr. Blair Bell, of Liverpool, must be confirmed by men of at least equal skill.

"The technique of Gye and Barnard is so refined and so delicate that not many scientists in the world are trained sufficiently to repeat their experiments," and Dr. Soper. "The best of cancer investigators are sailing on uncharted seas, and errors are difficult to avoid."

Progress in various angles of cancer research in the United States was described by Dr. William H. Woglom, of the Institute of Cancer Research, at Columbia University. "Although the laboratories have not yet succeeded in establishing a cure for cancer, the situation is not hopeless," Dr. Woglom pointed out. "It is not as though we were seeking a cure for hardening of the arteries or some condition where the damage appears to be irreparable. Malignant tumors do sometimes recede. This occurs in scarcely one per cent. of spontaneous tumors in mice, and in an infinitely smaller percentage of cases in man; yet the fact remains that the body does sometimes succeeed in overcoming the malignant cell."

How nature overcomes the wild cells of a cancer that grows spontaneously in a human being has not been studied because of the rarity of the phenomenon and the difficulty of such investigation. But Dr. Woglom described studies that are being made on rats with transplanted tumors in which the type of tumor that can be overcome by the body is compared with the tumor that flourishes. Study of 7,000 rat cases shows that on abou the tenth day the tumor takes a turn that decides whethe it is to continue to grow vigorously or to succumb to im munization by the normal body cells.

"There is not a single aspect of the cancer problem that is not under investigation somewhere in the world," concluded Dr. Woglom. "But such work can not be hurried. False trails must be investigated before they can be recognized as false. Experiments are wiped out by animal epidemics and have to be repeated. The ideal cure for cancer would be some agent, which, after intravenous or subcutaneous administration, could seek out and destroy the cells of a tumor without injuring the normal tissues of its bearer. Needless to say, the laboratory has no such remedy to offer as yet."

THE CAUSE OF BREAST CANCER

MOTHER mice which had bred a number of litters of young which were prevented from suckling their babies developed cancer far more frequently than normal mice. This is the latest contribution to the subject of cancer, presented before the American Society of Zoologists, in session at New Haven, Conn., by Dr. Halsey J. Bagg, of the Cornell Medical College. Mice that were allowed to suckle one set of babies and were kept away from the next, alternately, developed cancer after a shorter period than those kept from their babies entirely.

As a result of the experiments, Dr. Bagg is convinced that breast cancer in mice may be caused by stagnation and decomposition of the secretion in the breast during the period when the mother mice would normally give milk to their young.

Further evidence along this line was obtained by tying some of the breasts in some mice so that normal drainage of the secretion was prevented. In such cases he found that cancer tended to develop on the side that had been tied.

Dr. Adair, of Cornell, has shown that out of several hundred human cases of breast cancer a high percentage had abnormal activity of the breast glands, due to various causes. Only a small number of these cases had normal gland activity.

Whether cancer is caused by an organism or by abnormal cell growth, or whether a combination of the two is necessary, was discusssed at length. Dr. James Murphy of the Rockefeller Institute, expressed the opinion that Gye and Barnard, of London, have not presented sufficient evidence that a cancer germ exists. Their success in transmitting cancer of chickens by means of a filtrate free from cells may be due to the presence of some enzyme causing abnormal growth, rather than to ultra-microscopic organism which Gye and Barnard regard as responsible for the disease. He considered the fact that cancer can be produced in mice by application of coal tar to the skin as evidence against the theory that cancer is caused by an infectant.

When the definite cause of cancer is known, it will not only be valuable information for the cancer specialist but it will help physiologists to understand normal cell growth.

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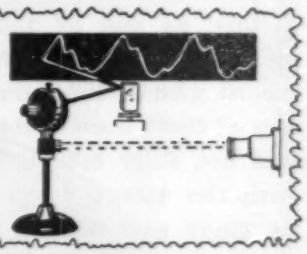

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Heredity may or may not be an important factor in cancer cases among human beings, but an experiment with laboratory mice, described by Dr. L. Strong, of Harvard University, indicates that heredity may play a part in unusual circumstances. He followed the development of cancer in a long family tree of mice, all descended from one original parent stock. After a long period of inbreeding there were two strains of mice, one of which was one hundred per cent. susceptible to cancer, whereas the other was much more resistant. This has no direct bearing on cancer in man, because such inbreeding of cancerous persons, as it is done artificially in the laboratory, is not likely to happen among human beings.

A NEW COMET

THE eleventh comet of the year has just been picked up by G. E. Ensor, an amateur astronomer at the Cape of Good Hope, where a southern branch of the British Royal Observatory is maintained. It is now in the constellation of Reticulum, the net, and is moving northeast into the neighboring constellation of Horologium, the clock, according to Dr. Harlow Shapley, director of the Harvard College Observatory. Both of these constellations are far south of the equator and can only be seen easily from southern latitudes. Its motion, however, may bring it into view in the southern United States, and, as it is now of the eighth magnitude, it could be seen with small telescopes.

With eleven comets discovered since January 1, some of which were new while others were old friends returning for one of their periodic visits, 1925 will go down in the history as one of the most prolific years for comets on record. The nearest approach in recent years to this record was in 1921, during which seven were found, but two of these were doubtful objects whose cometary nature was not fully established. All found so far this year, with the exception of the new one, have been observed by many astronomers and their orbits have been accurately computed. Doubtless other southern observatories will make observations of the new visitor, and as soon as its position at three different times is found, its path can be calculated.

This is the second comet this year to be discovered in South Africa, for on March 24, William Reid, an amateur astronomer living near Cape Town, discovered a comet which now bears his name. Another South African discovery of the year was that of a new star in the constellation of Pictor by R. Watson, another amateur astronomer, and a telegraph operator by profession, who noticed a strange star in the heavens when he was returning home from his work in the early morning. Two other of the year's comets were found by Americans, Professor George Van Biesbroeck, of the Yerkes Observatory, and Leslie C. Peltier, an amateur astronomer; while two others were found in Russia.

It is only coincidence that has brought this large number of comets near the earth this year, and no dire results may be expected from them. In earlier times, however, comets were supposed to portend great catastrophes, so it is a matter for thankfulness that most people no longer believe in these old superstitions.

ITEMS

THE record for minuteness in its class is held by a tiny fish shown at the meeting of the American Society of Zoologists at New Haven by Dr. E. W. Gudger, of the American Museum of Natural History. The midget is exactly 30 millimeters, or less than 1¼ inches, in length, and belongs to the semi-parasitic genus Remora. The fish in this group are parasitic only to the extent that they "hop a ride" on larger fishes, attaching themselves by a sort of vacuum disk that grows on the tops of their heads. This saves them the labor of swimming for themselves, and they pick up a living by swallowing bits of food scattered by their unwilling carriers at mealtimes. The next smallest specimen, which Dr. Gudger also showed, is a trifle over 1¾ inches in length.

ORCHIDS, which we carry in the habit of thinking of as very beautiful— and very expensive— exotic flowers, may sometimes become a serious economic pest, according to a paper presented before the Botanical Society of America by Dr. Melville T. Cook, of the Porto Rico Experiment Station. "Within the past year cases have come to my attention," he states, "where orchids of two species have proved very destructive in citrus groves. The orchids produce enormous growth of roots which cover the branches and causes a strangulation which frequently results in the death of large branches. The seeds are produced in great numbers and when the pests are once established in groves where the humidity is high, they spread very rapidly."

THE color of chickens seems to be controlled by a balance of glandular activity between their sex glands and the thyroids, situated in the throat, according to a paper presented by Professor Harry Beal Torrey and Benjamin Horning, of the University of Oregon, to the New Haven meeting of the American Society of Zoologists, giving the results of experiments on brown leghorn fowls. When thyroid substance was included in the diet of cockerels and capons, their feathers became darker as they matured, and the same was observed to a certain extent in the case of an unsexed female fowl. Normal hens, however, did not respond to the treatment; their feathers remained the same color throughout. The investigators therefore conclude that the darkening of the feathers was due to the action of the thyroid material, but that the female sex glands secrete an antagonistic substance that nullifies its action in normal hens.

THE night-blooming cereus, one of the most beautiful flowers of the desert, is not wholly a flower of the night, as has commonly been thought. The annual exhibit of scientific work at the Carnegie Institution of Washington includes two photographs of these rare plants being visited by bees that fly only in the daytime. Dr. D. T. MacDougal, of the institution, explains that the flower does not close with the coming of the first signs of dawn, but remains open for a time, usually giving the bees an hour or two of early daylight to work by, and thus freeing itself of total dependence upon night-flying moths for the important process of pollination.

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THE EVOLUTION OF THE STARS

THINGS are not always what they seem and stars with all the earmarks of old age may really be in their youth, astronomically speaking, according to the latest views of Dr. Henry Norris Russell, professor of astronomy at Princeton University. Dr. Russell's ideas on stellar evolution have been widely accepted among astronomers, but one difficulty that has puzzled them has been the fact that stars of nearly every possible type may occur in the same cluster. These different types are supposed to represent various stages in the normal evolutionary sequence, but it has also been thought that all the stars in the same cluster were formed at approximately the same time.

According to the latest improvements of his theory, however, Dr. Russell supposed that all the stars proceed through the same general course of evolution, but some are handicapped. The most massive ones start at the beginning, but those of less mass may start at the middle of the scale, without having passed through the earlier stages, while those of least mass start near the end. As a result, if a large number of stars is formed at about the same time, the ones of small mass will be almost immediately in the same condition that their more massive brethren will only reach after many billions of years. The astronomer, examining their light with his spectroscope, will find them of different types and may think them to be of different ages.

The source of energy of the stars, at one time thought to be due to a gradual contraction of their bodies, may be supplemented by actual conversion of their matter into energy, as proposed by Professor Eddington, of Cambridge University, England. Dr. Russell suggests that a star may at first contract, and then after it has reached a certain point, cease contracting and use up its actual substance by conversion to energy.

ULTRA-VIOLET RADIATION

THE ultra-violet radiation of the sun, invisible rays of too short wave-length to be seen, but which are responsible for tanning people's skins and which also affect photographic films, is increasing with the rise in the number of sun spots. This is the conclusion of Dr. Edison Pettit, astronomer at the Mt. Wilson Observatory, in a paper read before the Rochester meeting of the American Astronomical Society.

Dr. Pettit's studies have been concerned with the ultra-violet waves about one seventy-five thousandth of an inch long, just a little shorter than the deepest violet rays visible to the eye, which are about one sixty-five thousandth of an inch in length. As glass absorbs the ultra-violet rays, it has been necessary to use quartz lenses, and the amount of radiation is measured by means of a thermocouple, a device which gives a minute current when light, either visible or invisible, falls on it, the exact current being measured by means of a delicate galvanometer.

The method used has been to compare the ultra-violet radiation which passes through the quartz lenses and a thin film of silver, with green light passed through similar lenses, a green celluloid filter and a thin layer of gold, a series of measurements being made, first of the ultra-violet and then of the visible green light. The whole apparatus is attached to one of the observatory's telescopes, so that it can follow the sun in its motion across the sky.

When he first began his investigations in June, 1924, Dr. Pettit found that the amount of ultra-violet light from the sun was about two thirds that of the green, but as the atmosphere absorbs more of the ultra-violet than it does of the green he had to calculate what it would be if he could examine the sun's light before it passed through any of the air around the earth. In this way it was found that the sun gave off about 39 per cent. more of the ultra-violet than of the green, but in November, 1925, the ultra-violet radiation, when corrected for atmospheric absorption, was over one and a half times as great as the green, and it is still getting stronger. This means that the proportionate amount of the rays which tan the skin has increased 83 per cent. in the last year and a half. This, Dr. Pettit said, is in harmony with the increase in the number of sunspots, of which an unusually large number have been seen on the sun's face within the last few months.

THE INTELLIGENCE OF WHITE RATS

FIVE hundred white rats are being given intelligence tests to determine learning ability with respect to age in the Stanford University laboratories of psychology. The study is being financed by a grant from the Carnegie Corporation of New York of $12,000 to be extended over a period of three years. After the first year higher animals, such as the cat, will be studied.

The problem in the case of animals, according to Professor Calvin P. Stone, who is conducting the experiments, is to test the ability to learn at successive stages of development. With rats, ages of 20, 30, 50, 100 and 200 days are used. Intermediate ages may be used later in further expansion of the work. Both the learning of new habits and the breaking of old ones are to be tested.

Two types of tests are being conducted by Professor Stone at present, the problem box and the maze. The problem box is a square box of wire screening from which a door leads to another box containing food. The door can be opened only by stepping upon a small platform projecting from the side of the box.

When the rat depresses this platform with his feet an electric current releases the door leading to the food. A rat is given this test once daily for 20 days and the time required for him to depress the platform is noted. Then a period of 50 days is allowed to elapse before the test is repeated to determine his retention of the habit formed. About 100 rats of each age are being tested.

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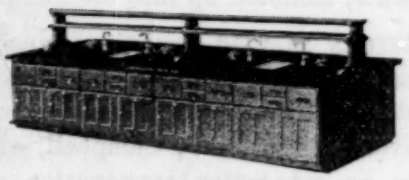

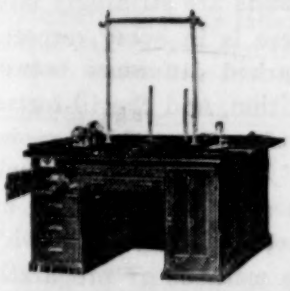

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rinthine passage containing many blind alleys, but only one direct path to the end, where food rewards the successful rat. A hungry animal is placed at the starting point and allowed to find his way to the exit. The number of false moves taken and the time required measure learning ability by this trial and error method. In addition to the 500 white rats now being used in these experiments, a breeding colony of about 100 animals is maintained.

A rough estimate of the relative rate of physical development in the rat and in man would be about 30 to 1. A rat one month old is equal in physical development to a child two and one half years old. Results now at hand would seem to indicate that the ratio of mental development is probably more nearly 50 to 1, according to Professor Stone.

Professor Stone began his present work June 1 and with one assistant worked seven hours daily during the summer. At present two research assistants are devoting four hours a day to the work.

NON-FILTERABLE BACTERIA

ELUSIVE, ultra-microscopic forms of life, minute as those which cause smallpox, scarlet fever, sleeping sickness and other diseases in human beings, are responsible for many of the diseases of animals, which cause an inestimable loss each year to farmers of every country.

Dr. Hubert Bunyea, avian pathologist of the U. S. Department of Agriculture, reported to the Washington branch of the Society of American Bacteriologists on the work that has been done in the control and eradication of these diseases in the United States and other countries. Rabies, foot-and-mouth disease, hog cholera, fowl pest, and bird pox, he said, are outstanding examples.

While the economic losses due to rabies are not as great as some, it is a very prevalent disease. All mammals, including man, are susceptible to it. It exists among the predatory animals of the Northwest, and this adds to its economic as well as its public health aspect.

The disease has been deprived of much of its horror by the discovery of Pasteur that animals and people could be rendered immune by repeated treatment with weakened doses of the virus. But the process is complicated and costly, and efforts to simplify it and make it practical for every-day use as a preventive in the case of domestic animals, have not yet been entirely satisfactory, Dr. Bunyea said.

Another germ too small for the microscope to disclose with ordinary light rays is the one that causes the foot-and-mouth disease and which has recently been made the subject of intensive investigation. This disease infects cloven-footed animals and is very contagious. The U. S. Bureau of Animal Industry has a commission investigating this subject in Europe. The bureau opposes the importation of any foreign viruses to this country, even for scientific study, in fear of their spreading and prefers to study them where the diseases occur.

Hog cholera, which once nearly annihilated the swine industry in many parts of the country, is also due to a virus of the extremely small kind. The actual organism is still unknown, although a serum with protective power has been in use for years. The organism not only passes through filters that retain ordinary bacteria, but it can not be grown in test tubes in the laboratory.

Fowl pest is also caused by ultra-microscopic bacteria. It existed in the United States last year, and is believed to have been spread from a sample of virus brought into the United States for study at one of the large eastern universities. Prompt measures eradicated the disease.

The organisms of fowl pest are very resistant under certain conditions and can survive for at least seven months in artificially stored blood. Fowls are more susceptible to their own special diseases than mammals and man are to theirs. Their semi-wild nature prevents their easy isolation and individual treatment, while their habit of flocking allows infection to spread rapidly.

The ultra-microscope, which uses X-rays instead of ordinary light, and can see what the ordinary microscope fails to reveal, has already been employed in the study of the minute forms of life that cause various animal diseases. So far the results have been only partially successful, but research of this sort has only just been begun, and the possibilities are unlimited.

ITEMS

No climate or race of people is exempt from cancer, and half a million die each year of the disease, says Dr. G. Fichera, in an article in the *Prensa Medica*. Europe alone accounts for 300,000 cases, and North America for 95,000. England's cancer mortality is placed at 45,000 a year, that of France at 24,000, Italy 27,000 and Argentina 5,700.

ECONOMIC losses running into many millions of dollars are caused in the United States each year by heart disease, according to Dr. J. G. Carr. "About one half of the patients with chronic heart disease are of an age at which their earning capacity should be at its highest and when family responsibilities are likely to be heaviest. This disease causes partial disability for years or total disability for over a year and a half." One third of the families represented in one of the dispensaries were dependent upon charity, and figures obtained by Dr. Carr from two institutions showed that the economic loss, both public and private, for only a small part of the heart disease patients, mounted up into the hundred thousands.

RETURN to food conditions much more primitive than those at present in vogue will be necessary if the ravages of dental diseases are to be checked. This is the lesson derived by Dr. T. D. Campbell, of Adelaide University, from an exhaustive examination of teeth and jaws of Australian aborigines which he finds are strikingly large, well-formed and healthy. "There is in every respect," Dr. Campbell says, "a very marked difference between the well-formed Australian dentition, and the ill-formed, disease-stricken masticatory outfit with which modern civilized peoples are burdened." The marked immunity from dental disease among the aboriginal children and grown-ups, he attributed to the coarse, tough food which formed their diet and the crude methods of preparation and cooking. Even children's teeth he found were well worn from chewing tough substances at an early age.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE SOLAR ECLIPSE

THAT the various expeditions of astronomers from the United States to Sumatra to observe the eclipse of January 14 were generally successful is indicated by reports received at Washington from the different institutions represented.

In a special cable to *Science Service,* Dr. John A. Miller, leader of the Swarthmore College Eclipse Expedition at Benkoelen, Sumatra, reported:

"We observed the eclipse of the sun this afternoon through a sky thinly clouded. We believe, however, that our plates are not seriously affected, except possibly those made with the Einstein camera to test the deflection of star light near the sun. The corona was of the type usually associated with maximum sun-spot activity and some very large prominences were visible."

Captain F. B. Littell, in charge of the party from the U. S. Naval Observatory, has sent word that the sky was partly clear at Telbinge-Tinggi. Dr. Harlan T. Stetson, of Harvard University, has reported to the Harvard Observatory that his observations were made through thin clouds but were partially successful. The Harvard party, including also Dr. W. W. Coblentz, of the U. S. Bureau of Standards, made observations on the west coast of Sumatra, not far from the Swarthmore College expedition, at Benkoelen. Months of study of the observations and photographs made will be necessary before definite results of the expeditions can be announced, however.

The regular round shape of the sun's corona as observed at this eclipse is, according to Dr. Louis A. Bauer, director of the department of terrestrial magnetism of the Carnegie Institution of Washington, what was to be expected because of the great number of spots that have appeared recently on the face of the sun. Between eclipses the shape of the corona can not be determined because the filmy pearly radiance haloing the sun can be seen from earth only during the time of total eclipse.

The number of spots visible on the sun at any one time varies in a period of about eleven years and the minimum of the present cycle occurred in 1922. However, the great activity of the sun in the last few months, as shown by the number of spots, indicates, according to Dr. Bauer, that the maximum will occur either this year or next, an unusually short time having elapsed between minimum and maximum. One very large spot which moved across the face of the sun and disappeared at the end of December with the solar rotation would have been on the edge if it had survived. This might well have caused the large prominences or red flames of hydrogen reported by Dr. Miller.

The astronomers will soon start home on their long journey. Dr. Miller and his party will sail from Singapore on January 28.

PREDICTION OF THE ERUPTION OF MOUNT VESUVIUS

THE recently reported activity of Mount Vesuvius, which may be only the prelude to a really important eruption, was prophesied several months ago by Dr. A. Malladra, noted Italian volcanologist, according to Dr. Henry S. Washington, of the geophysical laboratory of the Carnegie Institution of Washington.

"I was in Rome last summer when a report of a Vesuvius eruption excited the city," said Dr. Washington. "I wired to Dr. Malladra, who said that it was only a rumor, as such reports frequently are, but invited me to come down to Naples and go out for a look at the mountain anyhow.

"He showed me a place on the side of the volcano where, in his opinion, the next outbreak was due to come; and from what I can tell from reports that have reached me the new lava flows seem to be breaking out at this spot."

Vesuvius is no stranger to Dr. Washington. He has visited it every year or two for a long period, and took part in a special study of its last great eruption, which took place in 1906.

"Though this eruption is not to be compared with the cataclysm of 79 A. D., which wiped out Pompeii and Herculaneum," Dr. Washington stated, "it was really very severe. One or two hundred feet of the summit was blown off, and the crater was considerably widened. After the eruption the new crater had a depth of about 1,200 feet, with very steep sides.

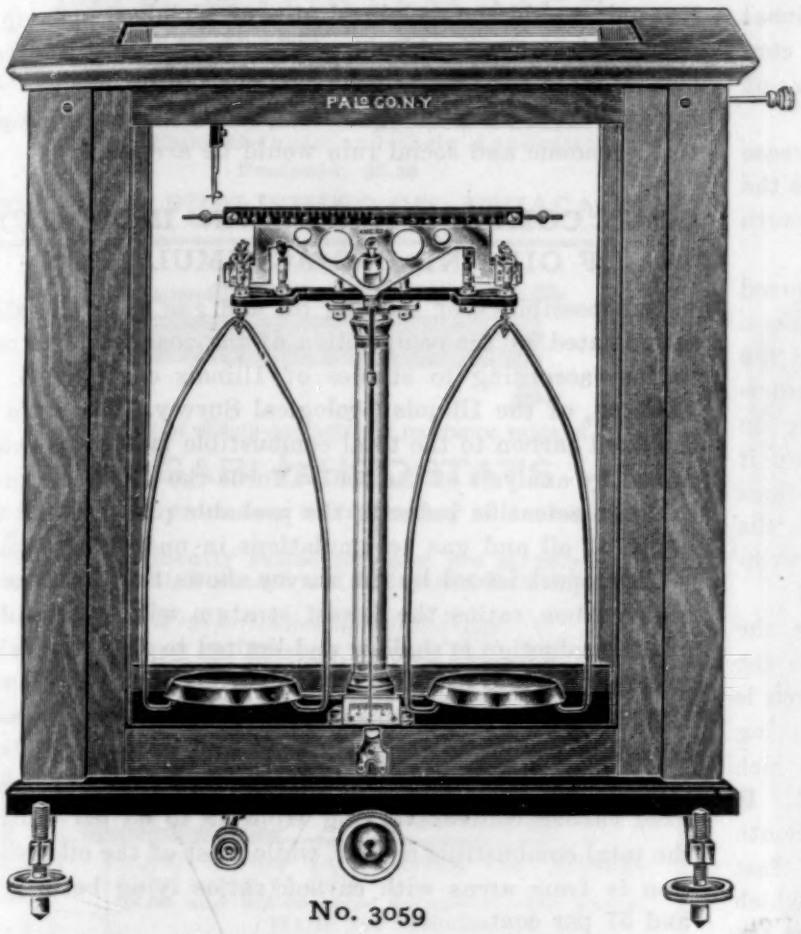
"Since that time it has been slowly filling up again, and a small cone, two or three hundred feet high, has been building. Last fall the lava level was up to within one hundred feet of the lowest point in the rim.

"Vesuvius, however, seldom sends lava flows over the rim of the crater; they usually break out on the sides of the mountain, accompanied with the eruption of vast clouds of smoke and ashes. The production of lava from Vesuvius is much smaller, proportionately, than that from Etna. Etna, of course, is a greater mountain, being 12,000 feet high as against the 4,000 feet of Vesuvius; and its lava is much more copious and also more fluid than that of the smaller volcano."

Dr. Washington scouted the idea that the volcanic activities in Alaska had anything to do with those in Italy. "Not only are these two widely separated regions quite independent of each other so far as their volcanoes go," he said, "but even in Italy the earthquakes that have been shaking Tuscany have nothing to do with the eruption of Vesuvius. The earthquakes of northern Italy are normal earthquakes, caused by the slipping of faults, or blocks in the crust of the earth, just as the Montana and Santa Barbara quakes were caused. Volcano tremors are local affairs, and are rarely felt even at moderate distances."

THE CLIMATE OF SOUTH AFRICA

"RAINFALL over the whole of the central portion of the Union of South Africa is steadily decreasing year by year, and if this goes on at the present rate, the time will come when vast areas now supporting a farming and grazing population will be given over to the wild beasts



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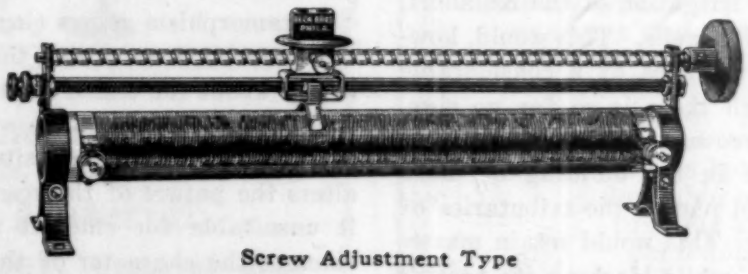

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of the desert. This process can, however, be checked. Its causes are known, and, being known, can be remedied.''

This startling statement is not that of a sensational journalist in search of a thrilling story, but the considered judgment of a scientist, Professor Schwartz, of the University of Stellenbosch.

Put in a nutshell, the reason for this gradual decrease in rainfall is the drying up of the big tract known as the Kalahari, 400 miles from the Orange River in the south to Lake M'gami in the north.

Up to comparatively recently, this area was traversed by a whole system of rivers dotted with several lakes. This water system connected Lake M'gami with the Orange River. But the lake which acted as feeding reservoir for this system is drying up owing to the silting up of the streams that fed it from the north. What water it still gets and holds has been diverted by some mysterious play of nature and now, instead of flowing towards the south directly, flows eastward into the Zambesi and westward into the Kunene and Okarango rivers.

So far has this process gone that, of recent years, the term ''desert'' has come to be generally applied to the Kalahari, although the word is a misnomer. The area is not by any means waste land yet; it is a vast undulating plain, partly covered with forest and partly with rich long grass whenever there is the slightest rainfall. It borders on one of the best cattle-raising districts in South Africa, Bechuanaland. The forests are, however, fast dying; there is ample underground water supply which may be tapped by artesian wells, but the water lies too deep to affect the roots of the trees. For mile after mile, one may see wilted and withered remains of what once were luxuriant growths.

To remedy this state of affairs, three schemes have been proposed, and the time is fast approaching when the Union Government will have to make its choice between them.

The first is a vast system of irrigation of the Kalahari, feeding the canals out of artesian wells. This would, however, require the presence in the area of a considerable population of settlers of which there is so far no sign. The intial expense would, moreover, be prohibitive.

The second scheme consists in the building of dams across the Okarango River and one of the tributaries of the Zambesi, the Chobe River. This would retain masses of water in M'gami lake and, while blocking its present ways of outflow, force the surplus water into the old, dried up channels passing through the Kalahari. There is little likelihood of this project being adopted on the score of expense, which would be enormous.

There remains the third scheme, which, in default of the more ambitious ones, stands the best chance of being adopted, and is backed by Professor Schwartz and other South African scientists. It provides for the construction of a dam across the Kunene River, which, it is calculated, would restore a great part of the old scheme of nature for the irrigation of the Kalahari.

Owing to the fact that labor, machinery, and to a certain extent, materials, would have to be brought to the spot from very great distances over difficult country lacking proper means of communication, the expenditure of money and time is likely to be very considerable, but the importance of the issues at stake is believed to justify it. Not only would the reclaimed area of Kalahari open up a vast stretch of magnificent grazing land, forest and valleys suitable for orange growing, but the process of drying up that is threatening central South Africa with eventual economic and social ruin would be arrested.

COAL COMPOSITION AS AN INDICATION OF OIL AND GAS ACCUMULATION

THE possibility of striking oil and gas in any locality is indicated by the composition of the coal found in that region, according to studies of Illinois coals by G. F. Moulton, of the Illinois Geological Survey. The ratio of the fixed carbon to the total combustible matter, as determined by analysis of the coal, affords the petroleum prospector a scientific index to the probable presence and the depth of oil and gas accumulations in underlying strata.

The report issued by the survey shows that in areas of high carbon ratios the lowest stratum with possibilities of oil production is shallow and limited to the later Paleozoic rocks, while in areas of low carbon ratios the lowest stratum with such possibilities lies deeper and includes the older Paleozoic formations as well as those of later origin. The coals mined in Illinois were found to have a fixed carbon content varying from 49 to 63 per cent. of the total combustible matter, while most of the oil production is from areas with carbon ratios lying between 54 and 57 per cent.

The explanation of this relationship between the composition of the coal and the presence of petroleum is found in the metamorphic changes brought about by heat and pressure to which the deposits are subjected. Geologists have recognized for some time that the degree to which rocks have been metamorphosed is a factor affecting the accumulation of economically important pools of gas and oil.

Metamorphism causes chemical and physical changes in the material from which the oil is derived and probably brings about the transformation. It enhances the circulation of fluids through the rock strata, thereby promoting the accumulation of deposits of economic importance. It alters the nature of the reservoir-rock, sometimes making it unsuitable for efficient retention of oil. Finally, it changes the character of the oil after its formation and, if carried to the extreme, scatters any accumulation and destroys its value.

The same conditions of heat and pressure which thus affect the accumulation of oil change the composition of the coal, and these changes, as expressed by the carbon ratio, were found to be closely related to the oil possibilities. The study of the petroleum-producing regions of Illinois shows that in areas where the carbon ratios are above 60 per cent., the oil and gas possibilities are poor, while the lower the ratios the greater the probability of large accumulations.

THE ECONOMIC WASTE OF HARD WATER

THAT hardness of water causes a great economic waste is shown by investigations of Dr. Arthur M. Buswell,

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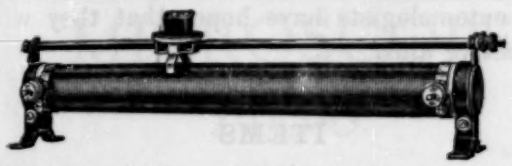

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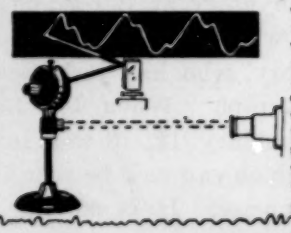

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chief of the State Water Survey of Illinois, and his staff of assistants who are trying to find a cheap, harmless, efficient means of softening water.

According to their investigations, the average town of 40,000 inhabitants in Illinois wastes a ton of soap daily because of the hardness of the water. Besides this waste of soap, the loss of heat because of boiler scale is enormous.

One sixteenth of an inch of boiler scale decreases fuel efficiency ten per cent. This would be great enough, but the boiler scale in Illinois is usually from four to eight times that amount, or from one fourth to one half an inch, thereby decreasing the fuel efficiency forty or eighty per cent.

This efficiency of fuel is comparable to the lowering of the boiling point of water by increasing the altitude. In Mexico City, where the elevation is 7,000 feet, the boiling point is 93.3 degrees Centigrade. This means that water at an elevation of 7,000 feet boils at a temperature that is 6.7 degrees below the normal boiling point of water at sea level, which is 100 degrees, or, in other words, that it is 93.3 per cent. efficient. The per cent. of loss of efficiency is therefore 6.7. This is in noteworthy contrast with the forty to eighty per cent. decrease in fuel efficiency caused by the hardness of the water in Illinois as noted above.

Fortunately, there are few states confronted with the problem of extremely hard water. Comparing Illinois with Massachusetts, we find that 300 to 600 parts per million contain mineral salts in Illinois, while in the latter there are few over 100 parts per million of mineral salts, and none of the water used for municipal supplies have more than 200 parts per million.

CAMPAIGN AGAINST THE CORN BORER

EVERY known device is being used to head off the advance of the corn borer from its original point of invasion in Canada toward the great corn belt in the middle west. So far, man instead of his foe, the skinny little caterpillar addicted to corn stalk diet, seems to be succeeding.

According to R. C. Walton, of the Bureau of Entomology, the economic damage in this country is not yet serious in spite of the heavy losses in Canada. A strict quarantine making it impossible to ship anything but shelled corn from the infested areas of Maine, Rhode Island, New York, Pennsylvania, Michigan and Ohio is believed to be chiefly responsible for keeping down the spread.

A strenuous campaign is being carried on by state experiment stations to educate the farmers in the best methods of combatting the pest. The borer eats up through the stem and sometimes into the ear causing the whole plant to fall over and die. Through the winter it lives in the dead stalks and cobs. Consequently burning over the fields in the fall is strongly urged. Unfortunately, the labor problem where corn tracts of great acreage are involved is so acute that this method is not always practicable.

Scientists at the Department of Agriculture and at the experiment stations throughout the infested regions are hard at work on the problem. Two wasp parasites have been introduced which lay their eggs on the borer. One causes paralysis and death at the initial sting while the young larvae of the other actually prey on the host caterpillar until it dies. These pests, artificially introduced to kill pests, Mr. Walton says, have been found in the field a year after their release, indicating their ability to survive in this climate when provided with proper corn borer diet. While it is too soon yet to tell how much they help, the entomologists have hopes that they will prove really effective aids.

ITEMS

NEW researches by the Carnegie Institution of Washington into the buried records of the ancient Maya civilization of southern Mexico and Central America will begin at Chichen Itza, Yucatan, in about two weeks, and will continue until the rainy season puts an end to excavation operations in June or July. Dr. S. G. Morley, who is in charge of the work, in now in Mexico City, where he will deliver two lectures on the discoveries thus far made. In addition to the further work of Chichen Itza, a new program is to be started at Uaxactun, Guatemala, where Dr. Morley and Dr. Franz Blom made a beginning some years ago. A contract covering the conditions of the research at this place has been concluded with the government of Guatemala.

THE first comet of the year, as yet so faint that it can only be seen with the most powerful telescopes, has been discovered by Dr. Walter Baade, of the Hamburg Observatory at Bergedorf, Germany, according to Dr. Harlow Shapley, director of the Harvard College Observatory, who has just received word of its discovery from Europe. When Dr. Baade saw it on the morning of January 12, it was in the constellation of the Lizard, which can now be seen in the northeastern sky just before sunrise. It is moving in a southeasterly direction into the neighboring constellation of Pegasus. Expressed in the celestial equivalent of latitude and longitude, its position at the time of discovery was 22 hours 27 minutes 52 seconds in Right Ascension and 40 degrees 18 minutes north Declination. At that time it was of the fifteenth magnitude. "This comet was originally discovered by Mechain, of the Paris Observatory, in 1790," said Dr. Shapley. "Then it was lost, and was not rediscovered until 1858 when Horace Tuttle, at the Harvard Observatory, found it again. It returns about every thirteen and a half years, and has been seen at every return since Tuttle."

IMPURITIES in radio detector crystals improve their operation, according to Dr. Edgar T. Wherry, of the Bureau of Chemistry of the U. S. Department of Agriculture. As a result of his studies of 75 minerals, he believes that sensitive spots, which the "cat's whisker" must tickle, are due to peculiar arrangement of the atoms, in which the electrons exert a greater attraction in one direction than another. This permits the current to flow better in one direction, and enables the crystal to do its work.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE KANSAS CITY MEETING

Press telegraphic reports sent by Watson Davis, Managing Editor, Science Service

THE NEW GEOMETRY

ALL straight lines are curved. Their two ends join in space to form enormous circles. Space is not "infinite" in the sense in which we are used to thinking of it. The universe is therefore a closed, not an open system, and its limits can be measured.

The new geometry, on which Einstein built and which in turn has been building anew on Einstein, is doing strange things to the ideas of the shapes of things which we learned as youngsters in high school, according to Professor James Pierpont, of Yale University, who addressed members of the American Association for the Advancement of Science meeting at Kansas City.

But though the old-fashioned straight line, which Euclid invented twenty-two hundred years ago to explain his geometrical ideas, must now go out of style, the new Einsteinian straight line, Professor Pierpont insisted, is straight in a real sense, straight as regards the actual world of things and not an imaginary space in which no matter or energy exists, for the new straight line actually measures the shortest distance between two points that can be obtained and measured in a universe full of suns and planets and masses of electricity, all pulling and pushing and hauling to warp space "out of shape."

And though its two ends do meet, thus making the Einsteininan straight line into what Euclid would have called a circle, the circle is so vast that any part of it measured on earth will still appear straight, even in the old-fashioned sense. Professor Pierpont gave its circumference as eighteen quintillions of miles, in round numbers.

A geometry that deals in such vast magnitudes as this, it was suggested, might appropriately demand a new name, for the older geometry meant literally "earth measurement" and was invented in the first place to help land surveyors. This world-measuring system might well be called "cosmometry."

The new geometry, although it first began to be talked about extensively in 1914, when Einstein propounded his theory, has roots that run back about a century. It began about 1823, when a Russian named Lobachevski and a Hungarian named Bolyai questioned the orthodox Euclidian assumption that a given line could have only one line drawn parallel to it through a given point. They were able to build consistent geometrical systems with this axiom left out, and later workers in Germany, notably Riemann, also tried their hands at making geometries that left out certain of the "self-evident" propositions of Euclid.

But these geometries were all like Euclid's in that they worked in a vacuum. Einstein worked out his system for the actual physical universe, for x "a space whose structure is in constant flux, changing with every displacement of gravitational or electric masses." Moreover, the old geometries had to depend entirely on arrays of formal logic for their demonstration, whereas the new gives the means of experimentally determining its own structure.

THE STELLAR GALAXY

THE earth and its sister planets are at least two thousand million years old, yet their destruction through the close approach of the sun to another star will not occur for about a quadrillion years.

Such was the prediction of Professor Frank R. Moulton, of the University of Chicago, who discussed our stellar galaxy, the largest organism whose evolution has ever been considered.

"Our galaxy consists of at least a thousand million suns," he said, "each one, like our own, averaging a million times the volume of the earth. These suns occupy a disc-like or watch-shaped region in space, whose thickness is the distance light travels in about 30,000 years, and light travels 186,000 miles per second. The longer diameter of the galaxy is about 200,000 light years.

"The stars of this galaxy move around among one another something like bees in a swarm. This does not mean that they dart quickly from one side to the other, for although our sun is moving at the rate of 400,000,000 miles per year, the distance between the stars are so vast that its relations to other suns have not changed appreciably in historical times.

"When one sun passes near another sun, any planets that they may have had are destroyed, and new ones begin to be developed from their disintegrated remains and materials which may be ejected from the suns themselves. Our earth and the seven other planets of the solar system had their birth when our sun last passed near another star, which we know from the distribution of radioactive materials in our rocks, was at least two thousand million years ago. Our present planets will be destroyed in some remote future when our sun again passes near another star. This catastrophe will probably not happen for hundreds or perhaps thousands of millions of years to come. We only know that on the average our sun, or any other star, will pass near another member of the galaxy once in about 1,000,000,000,000,000 (one quadrillion) years. This is in round numbers the average lifetime of a family of planets.

"Until recently many astronomers thought there was only vacant space beyond our galaxy. But now it is known that there are exterior galaxies, similar to our own in size and shape and number of suns. Only about a year ago Dr. Edwin P. Hubble at the Mt. Wilson Observatory determined the distance to an exterior galaxy which had heretofore been called the Andromeda nebula, and found it to be a million light years."

Professor Moulton showed a photograph which was taken with light that had been on its way a million years. "There are hundreds of thousands of similar

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objects, which are probably more remote exterior galaxies,'' he stated. ''Just as sun passes sun within our own galaxy, so galaxies may at much longer intervals of time pass near one another. The spectroscope shows that their relative velocities are generally at the rate of thousands of millions of miles per year, and the high velocity determined by Dr. Dayton C. Miller in his ether drift experiments may indeed be in large part the motion of our entire galaxy through the ether. ''If a galaxy were left alone,'' Professor Moulton said, ''it would undergo a long dynamical evolution and would tend toward a state in which the stars would be symmetrically arranged in concentric layers. Our galaxy has not arrived at that state, for it now consists of great streams and clouds of stars, somewhat irregularly distributed. This does not mean that it was created recently, in the astronomical sense of the term, but that it has encountered in recent astronomical time another galaxy which has spun it out into a vast disc-like mass, which yet contains numerous irregularities.

''About half of the thousand million stars in our own galaxy are in size and constitution and temperature essentially similar to our own sun. It is not improbable—it is, in fact, probable—that a majority of them have planets circulating about them as our earth revolves about the sun. It may be that a fraction of them—perhaps in all hundreds of millions—are in a condition comparable to that of the earth, and that they support life. Some of them are probably in the state that our earth was in five hundred millions of years ago, and some of them are in the state that our earth will be in five hundred millions of years hence. When we reflect on the changes that have taken place on the earth in a much shorter period of time, and particularly on the changes in human beings, our imagination is staggered by the possibilities.

''The impressive thing to the astronomer is not the magnitude of the galaxy nor the long periods of time during which stars exist, nor the tremendous forces of nature, but the most impressive thing to him is that all this vast universe which we have been able to explore is found to be orderly. The orderliness of the universe is the foundation on which science is built. It is the thing that enables us to understand the present, to look back over the past, and to penetrate the remote future. This discovery more than compensates us for the relatively unimportant position that man occupies physically.''

FITTER FAMILIES AND PSYCHOLOGICAL TESTS

Is your family ''certified?'' This is the question that fond and careful parents may soon ask of suitors for the hands of their daughters.

For there is a movement underway under the auspices of the Eugenics Society of the United States of America which will soon allow families of satisfactory health, history and heredity to obtain credentials which distinguish them from those who can not come up to a high eugenic level.

Dr. Florence Brown Sherbon, professor of child care and director of bureau of child research, University of Kansas, explained this project to the American Association for the Advancement of Science.

''Fitter Family'' competitions are now being put on at state fairs and exhibitions and staffs of professional physicians, geneticists, psychologists and others examine these families and score them in a manner somewhat comparable to the way in which stock and other fair exhibits are judged.

The movement to certify families and individuals from a eugenic and health standpoint originated with the first competition held by the Kansas Free Fair at Topeka six years ago and this year fitter family competitions have been held at seven large expositions and state fairs. In Kansas the governor gives a silver trophy cup to the blue ribbon family and individuals who measure up to the high standards get a medal. A plan is also being evolved which allows non-competitive examinations as well. Contestants are scored upon the following data: Family history and heredity, psychological measurements, psychiatric tests, physical and medical condition, condition of eyes, ears, nose and throat, condition of teeth, laboratory tests, health habits.

''The object of the fitter family movement is the stimulation of a feeling of family and racial consciousness and responsibility,'' Dr. Sherbon explained. ''We believe that eventually there will be created a sentiment for certified families as distinguished from those who can not or do not obtain evidence of being able to pass the rather rigid tests of the examinations.''

Not only have parents and children been subject to test, but engaged couples and single individuals of marriageable age have used fitter family competitions to assure themselves that they are worthy of becoming parents of the next generation.

There are geniuses and morons among chimpanzees just as there are among human beings, Dr. Edgar James Swift, head of the department of psychology, Washington University, St. Louis, told the psychologists in contending that the idea that apes can not show volition or will must be revised.

Recent experiments, made by the famous German psychologist, Dr. Wolfgang Kohler, show that a few apes behave as man behaves when, as we say, he wills to do something. Kohler's chimpanzees piled boxes upon one another three or four stories high to reach food, got a hidden ladder seen a short time before and performed other acts that were certainly not instinctive. Dr. Swift, defining will as the control of the activities for the attainment of desired ends or avoidance of undesirable results, explained that its essential factors seem to be memory, the ability to hold two or more ideas in mind simultaneously, to connect them in thought and to make some sort of comparison of their utilities. The exceptional apes, like most men, exhibited these qualities.

Mental tests applied to high-school freshmen serve to indicate what sort of grades the student will make in abstract subjects, but in subjects dealing principally with mechanical actions and material things they do not predict so well, Professor J. C. Peterson, of the Kansas State Agricultural College, reported.

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A test for personality was described at the psychological sessions by Professor John J. B. Morgan, of Northwestern University. It consists in showing the person being tested series of ten symmetrical ink blots, some with black alone and others with red, green and yellow intermingled with the black and asking the simple question: "What might that be?" His reaction to these figures classes the subject as conventional or of a certain personality type.

SCIENCE AND AGRICULTURE

WHAT science has done and can do through agriculture to solve the great problem of bread for the coming crowded generations occupied a considerable share of the association's attention. President F. D. Farrell, of Kansas State Agricultural College, told of the romance of the conquest of the plains of the West.

"During the past eighty years this country has witnessed a transformation which, in kind and magnitude, probably has no equal in history," President Farrell told his hearers. "It is the transformation of an area of hundreds of thousands of square miles of land from what once was universally regarded as a desert to what is now one of the most important areas of food production and of population in the Western Hemisphere."

This transformation of the plains, which even the early explorers who actually saw them regarded as an impassable barrier to migration, was largely the result of scientifically designed agricultural machinery, permitting farming on a vast scale, and partly of the introduction of new crops suited to the region, found in foreign lands by agricultural explorers.

Dr. W. A. Orton, of the Tropical Plant Research Foundation, discussed the botanical problems of American tropical agriculture. The greatest contributions of the tropics in the future, he said, will be of sugar, oils and fruits. The principal industry of the tropics will probably continue to be agriculture, but for its fullest development much scientific work will have to be done which is now in its very earliest beginnings. As an example, Dr. Orton pointed out that such important crops as rubber, coffee and cacao, and most of the tropical fruits, are still propagated from seeds, whereas virtually all the important tree crops of the temperate countries have been for years, sometimes for centuries, carried on as choice grafted stocks and not left to the uncertain chances of seedling growth. Another problem pointed out by Dr. Orton is the apparently paradoxical lack of fresh vegetables on the tropical menu. Whatever may be the cause of this deficiency, he said, medical workers find that part of the lassitude and inefficiency of native laborers is apparently due to a lack of necessary vegetable vitamines.

That the rôle of the tropics in supplying the staple foods of the future will be at most a secondary one, is the opinion of Dr. E. D. Ball, former assistant secretary of agriculture and now Florida state entomologist. He agrees with Dr. Orton that the amounts of accessory agricultural products from the tropics will increase greatly, but believes that the production of breadstuffs and meat will continue to be mainly the affair of the lands that now produce them. He holds therefore to a program of intensification of the methods whereby the "Great American Desert" was conquered, as described by President Farrell.

AWARD OF THE ASSOCIATION PRIZE TO PROFESSOR MILLER

THE award of the $1,000 prize of the American Association for the Advancement of Science to Dr. Dayton C. Miller, Case School of Applied Science, Cleveland, is a recognition of patience, perseverance and service to science as well as an acknowledgment that the results of Dr. Miller's work may require serious changes in the prevalent idea of the way the universe is put together.

The observations made in the course of the ether drift experiments during 1925 consisted of over 100,000 separate readings, a procedure that required Dr. Miller to walk, in the dark, in a small circle, for a total distance of 100 miles, while making at very frequent intervals the most delicate measurements possible.

Dr. Miller said in his prize paper: "I think I am not egotistical, but am merely stating a fact when it is remarked that the ether drift observations are the most trying and fatiguing, as regards physical, mental and nervous strain, of any scientific work with which I am acquainted."

That the results reported in the paper that the judges selected as a notable contribution among the thousand papers of the Kansas City meeting will have a far-reaching effect on the foundations of physics and astronomy can not be doubted. Dr. Miller repeated the experiment that is fundamental to the Einstein theory and found that the accepted interpretation of the famous Michelson-Morley experiment of 1887 must be reversed. There is an ether drift, the earth does carry along with it through space some of the ether, whereas the Einstein theory was built upon the assumption and the results of the 1887 experiment that showed no such drift.

Either the Einstein theory must be modified to meet the new facts, or, if such modification is impossible, it must be scrapped. When Dr. Miller announced preliminary results at the April meeting of the National Academy of Sciences, Einstein acknowledged that the data if confirmed would be a serious blow to his theory in its present mathematical formulation. Physicists believe, however, that results of Dr. Miller are possible of reconciliation with a theory of relativity worked out upon the new assumptions and facts.

That the earth with the solar system is speeding through space at the rate of 125 miles a second or more, ten times the speed previously suspected, was also shown in Dr. Miller's experiments. Professor F. R. Moulton, of the University of Chicago, during the meeting explained that this high velocity may mean in part that our own stellar galaxy or universe is rushing through the ether. If so, the astronomers may be revising some of their ideas of the composition of the universe.

Dr. Miller first began his experiments on ether drift thirty years ago. Soon he will again journey to Mount Wilson to repeat the experiments. Such is the method of science; the rewards are an inspiration to mankind.

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SCIENCE NEWS

Science Service, Washington, D. C.

TRANSMUTATION OF THE ELEMENTS

ELEMENTS can actually be transmuted and one metal can be converted into another. This seems to be demonstrated by experiments reported to the British scientific journal, *Nature*, by Dr. Arthur Smits and Dr. A. Karssen, of the University of Amsterdam. Base lead has, under the influence of electric current in a quartz lamp, been changed into mercury and perhaps into thallium, according to the claims of these two scientists.

The Dutch experiments tend to support the claims of Professor A. Miethe, of the University of Berlin, and Professor Hantaro Nagaoka, of the Tokyo Imperial University, that they have changed lead into gold. When their claims were first made, many scientists doubted that such a change could be effected without the use of vast amounts of energy, far more than any of these modern alchemists have used.

One of the first to claim that he had solved this ancient puzzle was Professor Miethe, who, in 1924, announced the result of experiments with a mercury vapor lamp, similar to that giving the violet light often used in photographic and movie studios, and in which an electric arc operates in a vapor of mercury. He was assisted in this work by Dr. H. Stammreich, and in one series of experiments the lamp was operated for 197 hours with an electrical force of about 160 volts at 12.6 amperes, a current of about the same order as that used in lighting our homes. Though the mercury was shown free from gold at the beginning, slight traces of yellow metal, less than three ten millionths of an ounce, were found at the end. Minute as such an amount is, delicate chemical tests can detect it, and the tests in this case were made by Dr. Fritz Haber, considered one of the greatest of German chemists. In later experiments, Dr. Miethe claimed that he had obtained the gold in much larger quantities, enough to test by the ordinary laboratory methods, but not enough to make the method commercially practicable.

According to modern conceptions, the atoms of which all matter is made consist of a nucleus made up of what are called protons, around which revolve a number of electrons, much as the planets revolve around the sun. The outer electrons, in fact, are referred to as "planetary electrons." The difference between elements, according to this theory, is due only to the electrical charge of the nucleus and the number and arrangement of the planets. In the case of elements like radium, the atoms break apart spontaneously with the liberation of helium, whose atom is the simplest known next to hydrogen.

Theoretically, then, it seems easy to change the atom by merely knocking out some of the planets, but this does not affect the nucleus. Dr. R. A. Millikan, of the California Institute of Technology, has thus obtained what he calls "stripped atoms" of some elements, in which the outer ring of planets has been removed, but this does not radically alter the elements.

To break into the nucleus, the central "sun" of the atomic solar system, would require, in the opinion of many scientists, vast amounts of energy. Since mercury is next to gold in the procession of the elements, the removal of a single charge, corresponding to the complete nucleus of hydrogen, which is the simplest of the elements, would convert mercury to gold. But the nuclei of other elements have been bombarded with an energy corresponding to five million volts, with no sign of disintegration.

Now it seems, however, that comparatively small amounts of energy are able to get in where larger amounts have failed, and the work at Amsterdam is taken as confirming the atomic theories. The method of the Dutch scientists, however, was slightly different from that used by Miethe and Nagaoka, for instead of mercury they used lead, its close relative. The lead was melted and the tube filled with its vapor. Though the lead was free from mercury, as demonstrated by the fact that spectral photographs of the light from the tube showed only the lead spectrum, after a current of 60 to 100 amperes had been passed through it in the form of successive sparks for a time, the lead spectrum gradually began to disappear. Instead of the lines indicating this element, those of mercury gradually appeared on the plate, together with those of thallium, a rather rare metal which lies between lead and mercury in the list of the elements.

Though the lead spectrum almost completely disappeared, "this does not prove the transmutation to be strong," Professor Smits reports, "as it is known that a small quantity of mercury can cause the spectrum of another element to disappear. But at all events, our spectra show in a very convincing way the transmutation of lead into mercury."

The presence of this synthetic mercury was confirmed by a chemical test, for when iodine vapor was passed through the tube containing the product of twelve hours of sparking, the familiar red color of mercury iodide appeared.

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This is the conclusion of Professor R. Debre and Dr. Joannon, of the University of Paris Medical School, reported to the Health Committee of the League of Nations. More than a thousand injections of the serum have been without any bad effects. The efforts of Dr. Leon Bernard, of the University of Paris, resulted in the establishment of two prophylactic stations in Paris for the treatment of the disease.

"Up to the present time," Dr. Bernard said, "prophylactic methods have been used to some extent in the United States and Germany to secure temporary immunity. A serum from convalescent cases was used and injected in patients during the first six days after infection.

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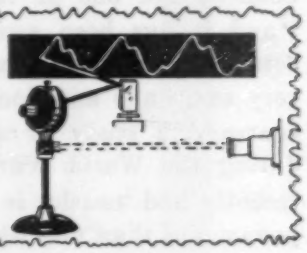

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"But a durable immunity may be developed if the serum is not injected until the germs have had more time to incubate, as in the modified procedure of Professor Debre, where the injections are made only between the sixth and the tenth day after infection. A serum shortage problem was solved by the discovery that the serum of adults who have long since recovered from measles was as efficient as that taken from convalescent children."

It is often forgotten, Dr. Bernard said, that measles is a serious disease, and there is no other disease to which man is so universally susceptible. Every year there are thousands of deaths in France alone, and statistics from the most important countries show that the death rate from measles is falling more slowly than that of diphtheria, smallpox, scarlet fever and whooping cough.

Measles caused about a million deatns in Europe between 1900 and 1910, and in the death registration area of the United States from 1901 to 1920 there were more than 100,000 deatns. Measles is more dangerous in cities than in the country, and in Europe, at any rate, the danger is directly proportioned to the density of the population, Dr. Bernard said.

Although as old as medical history, and so common that in cities over 90 per cent. of the population have had the disease by the age of eighteen, measles is still one of the mystery diseases which it has been extremely difficult to combat. It is believed to be caused by an extremely small organism which can not be seen with the ordinary microscope, and which passes through a filter which stops ordinary germs.

With the possible exception of smallpox it is the most contagious disease known to man, and, according to the U. S. Public Health Service, it is difficult to control because the symptoms of the disease are not obvious until about four days after infection.

"The importance of measles is frequently underestimated," said Dr. Victor C. Vaughan, chairman of the division of medical sciences of the National Research Council, and one of America's leading epidemiologists, "and it has been commonly believed that the disease acts as a weeding-out process to eliminate the unfit at a very early age and does no harm to the strong. On the contrary, a study of measles in the U. S. army camps during the World War revealed that a person who has recently had measles is ten times more likely to die from pneumonia than one who has not.

"It is not over-sanguine to claim," Dr. Vaughan continued, "that if this disease, together with whooping cough, diphtheria and scarlet fever, could be entirely suppressed, the average length of life would be increased by at least ten years.

"There is great probability that the work of Drs. Bernard, Debre and Joannon will lead to an eventual control of the disease."

THE DANGERS OF TETRAETHYL LEAD

TETRAETHYL lead "knockless" gasoline is safe to handle and use as fuel, though the anti-knock compound itself is still recognized as dangerous in its concentrated form. This is the gist of the findings of the special committee of the U. S. Public Health Service that has been investigating the problem brought up by the alleged "lead-gas" poisonings some months ago.

The committee examined 252 men, most of them ex owners and users, employees in garages, power plants and public service corporations in Dayton and Cincinnati, Ohio. Part of them handled and used gasoline treated with tetraethyl lead, and the others only untreated gasoline. One group of 60 was exposed to lead as a direct industrial hazard. Thorough physical examinations were made of all of them by doctors who were not permitted to know which of their subjects were exposed to the ethyl gas and which were not. The general tenor of the results of these examinations is to the effect that no health differences can be found among these men that can be traced to their exposure to the treated gasoline.

It was found that practically all the men eliminated lead from their bodies, whether they were exposed to the suspected fuel or not. This indicated that they were absorbing lead from other sources. The committee found appreciable quantities of lead in the dust in garages, presumably from tires, battery plates, etc. The suggestion is also offered that lead may be taken in with drinking water, from plumbing consisting in part of lead pipes.

In addition to the lead in garages, the committee found that the air in the Dayton Municipal Garage contained from two to seven parts per ten thousand of the poisonous carbon monoxide gas when cars were operating.

Representatives of the American Federation of Labor of the U. S. Public Health Service and of the manufacturers of ethyl gasoline are now drawing up a system of regulations to apply to the manufacture, blending and distribution of ethyl gasoline. These recommendations are expected to form a basis for any future state and municipal regulations on the subject. The sale of anti-knock gasoline, which has been voluntarily suspended during the investigation, will probably be resumed in a few days, except where prohibited by local authorities.

On the basis of this investigation, the committee feels that the following general conclusions are justified:

(1) Drivers of cars using ethyl gasoline as a fuel and in which the concentration of tetraethyl lead was not greater than one part in 1,500 parts by volume of gasoline, showed no definite signs of lead absorption after exposures approximating two years.

(2) Employees of garages engaged in the handling and repairing of automobiles and employees of automobile service stations may show evidence of lead absorption and storage, as indicated by the lead content of the feces and the appearance of stippled cells in the blood. In garages and stations in which ethyl gasoline was used, the amount of apparent absorption and storage was somewhat increased, but the effect was slight in comparison with that shown by workers in other industries when there was a severe lead hazard and for the periods of exposures studied was not sufficient to produce detectible symptoms of lead poisoning.

(3) In the regions in which ethyl gasoline has been used to the greatest extent as a motor fuel for a period of be-

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tween two and three years, no definite cases have been discovered of recognizable lead poisoning or other disease resulting from the use of ethyl gasoline.

HOME-GROWN RUBBER

ALL the schemes to take a belated stitch in the American rubber dilemma which resulted when Great Britain pulled in her supply are beset by difficulties. One of the least known of these schemes, although not necessarily the most unpromising, is that for growing rubber at home under the semi-tropical sun of Florida and California.

The U. S. Department of Agriculture has been trying out seeds and plants of various rubber-producing species in experimental gardens, but as it takes a long time for the plants to mature and produce latex, officials have as yet no information to give out, and they are advising enthusiastic investors not to put any money as yet into Florida or California rubber.

Botanists name a long list of plants which will produce the milky sap containing rubber. The most important of these is the Para rubber tree, *Hevea guianensis*. It grew originally in the Amazon Valley, but was bootlegged out more than half a century ago by British planters who tried it out in Kew Gardens, London, and in Ceylon, to see if it would grow outside of Brazil. Then it was used to start the vast plantations in the East Indies that are now supplying the world with most of its rubber.

"Healthy seedlings of the Para rubber tree have been grown at the U. S. plant introduction gardens near Miami, and are being transplanted to different conditions of soil and exposure," Dr. W. A. Taylor, chief of the Bureau of Plant Industry, stated in his annual report to congress. "The collection of rubber plants now growing at Miami includes altogether about twenty different types.

"Rubber plants that are natives of dry regions are being tested in California, in the coast regions as well as in the interior valleys," he continued. "Several dry-country rubber plants are known in Mexico, while others are reported in South America, Africa and Madagascar. The production of rubber from the Mexican guayule plant has been investigated by a private corporation and the stage of agricultural practicability is believed to have been reached in California.

"Desert types of rubber plants are being grown in the lower valley of the Colorado River, and the possibilities of one of the common milkweeds are being studied because it grows well on waste lands and produces a large quantity of rubber-bearing material readily and cheaply. Cultivation might extend over large areas if ways of utilizing the substance were perfected.

"This plant is widely scattered in southern Arizona and the desert regions of Sonora and southern California, and it also grows in small ravines and gullies of barren hillsides a few miles from the coast of Lower California. Some of the plants grow so large that they form dense masses more than six feet high and ten feet across."

If any of the rubber-bearing species does show a willingness to produce rubber in the United States in worthwhile quantities, many economic problems would still have to be solved before rubber-growing could be done on a commercial scale.

Para rubber, if that should be chosen, would not ha the even rainfall it has in the East Indies because Flori has distinct wet and dry seasons. With even rainfa rubber trees may be tapped the year around, but wi an uneven one, tapping would have to be seasonal. Th would involve labor complications, because at certa times a great number of laborers would be needed, and others only a few.

Even if that problem could be satisfactorily solved b secondary crops, there would still be a labor proble East Indian rubber planters can get cheaper labor tha Florida or California planters can ever hope to ge Therefore, some other means would have to be found t reduce the cost of producing the rubber in order to com pete with England's East Indian product in price.

The research chemist would have to work out ne means of getting the rubber out of the latex, certainly cheaper and better way. In case one or more of the lesse known plants were to be used, for which no method of ex traction is now known, a brand new method would ha to be developed. On top of it all, the chemists migh come along any day with a cheap synthetic rubber tha would stretch as far as the best of nature's product.

ITEMS

IMMORTALITY of the human body is forecast in experi ments of Dr. Leo Loeb, at Washington University. Ha ing successfully transplanted tumors and kept them aliv indefinitely, Dr. Loeb has turned his attention to healt tissues with some success. Cartilage, popularly terme gristle, has been grafted from one rat to another, an the transplant has not only continued to live, but it ha proliferated itself also. The transplants must be mad to a host of the same species, said Dr. Loeb in detailing his experiments to date. Usually grafted tissue can no be cultivated in this way, but cartilage is different, an it responds to the process. Cartilage cells, implanted in another individual, continue to divide for two and a hal to three years. By serial growth—transplanting again t a third rat—the age of the cartilaginous tissue can b increased to five years. This is much greater than th age which rats usually attain. Cartilage, at least, is potentially immortal.

How America can use the great outdoors to promot health and happiness was discussed when representative of 133 national organizations met in Washington for th second annual conference on outdoor recreation on Janu ary 20 and 21. The session opened with an address by Secretary of War Davis, chairman of President Coolidge' committee on outdoor recreation. Secretary of Commerce Hoover spoke at the dinner. The chief topics considered at the meeting were the projects which the national rec reation conference have been conducting during the past two years, including surveys of state forests and parks, municipal forests and parks, and federal lands which might be used in various ways for outdoor amusement. Other subjects of importance brought before the con ference were fish and game control, migratory bird laws and the development of state highway systems in con nection with recreation projects.

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SCIENCE NEWS

Science Service, Washington, D. C.

TESTS OF THE BLOOD OF NATIVES OF AUSTRALIA

DELICATE biochemical tests show a marked similarity between the blood of many of the very primitive natives of Australia and that of white men of the most advanced civilization, according to Dr. Clark Wissler, of the American Museum of Natural History, who has returned from what he calls "anthropological reconnaissance trip" to the southern continnet.

"I did not have time enough to get into the real interior of Australia," said Dr. Wissler, "so I confined myself to an effort to get into touch with what might be called 'borderland' natives—aborigines living near lines of travel, who have not yet been too thoroughly demoralized by their contact with civilization. I was fortunate enough to meet a whole tribe who had come down to visit a related group settled at a mission station near one of the great sheep ranches. Dr. J. B. Cleland, of the University of Adelaide, made the blood tests of several hundred of the natives, and Dr. R. H. Pullein made medical examinations.

"Though the blood tests require the drawing of only a single drop of blood, we could not be certain how the black men would receive our request for even that much, because of tribal taboos and superstitions. But Dr. Cleland explained to them that we wanted to see whether 'black man's blood all-same white man's'. The natives make a great deal of ceremonial blood kinship, and this appealed both to their curiosity and their pride; so they readily consented. It was found that very many of the natives had blood of types closely similar to that of white men."

The Australian natives, according to Dr. Wissler, have been rather maligned by travelers and earlier students of race questions. They are not, he states, as degraded a lot as current opinion would make them. He regards them as a primitive people who migrated into a very unfavorable country, where the struggle for existence is always severe, and who on this account have suffered from arrested development. On account of the climate they need no clothes and very little shelter, so that they have never developed the arts that other primitive peoples have. Because a large part of Australia is semi-desert the food problem is always pressing, making necessary the use of literally everything, even reptiles and insects, and forcing a nomadic life upon the people. The habits that have grown out of these necessities naturally do not make their possessors very attractive in the eyes of Europeans.

It is a mistake, however, Dr. Wissler thinks, to set the Australians down as a people of low intelligence. He points out that they have developed a most elaborate social code, and that their ability as trackers of game is almost uncanny. Such accomplishments are not attained, he says, by stupid men; within their limits the Australian natives are not to be despised.

Civilization, however, is ruinous to the aborigines, Dr. Wissler stated. The tribes that used to inhabit the eastern and southeastern parts of Australia have simply disappeared—died out; and those who now live in or near the cities degenerate rapidly. The governments of the Australian states now have regular officials whose business it is to guard the interests of the natives who are as yet unspoiled, and who cooperate with the mission stations in taking care of their material wants.

Not only the natives of the continent itself, but those of the former German possessions in the South Pacific, now mandated to the federal government of Australia, are the objects of scientific solicitude on the part of the government, Dr. Wissler said. In an effort to carry out the full spirit of the mandate idea, the Australian government is backing a thoroughgoing scientific investigation of both the peoples and the resources of the islands, in order if possible to develop both the people and the islands to their full possibilities and to avoid the period of ruinous exploitation that has usually followed the opening up of new territories inhabited by primitive races. At the University of Sydney a new department has been opened for the double purpose of training men for colonial service in the mandated islands and of carrying on research work in anthropology.

"The Australians realize the difficulties in their way," said Dr. Wissler. "They realize also the handicaps under which they are having to work, being a small nation and one hard hit by the war at that. But they are going at it with their eyes open and intend to make an honest effort."

RESEARCHES ON RICKETS

NEW cures have been found for rickets, a serious disease of children and young animals due to defective bone structure, in three substances commonly found in the bodies of all animals. They will be reported by Dr. Andor de Bosanyi in the next issue of the *Bulletin* of the Johns Hopkins Hospital.

Rats afflicted with rickets were fed on a diet containing hemoglobin, which is the red coloring matter found in blood corpuscles. When the diet contained from five to six per cent. by weight of this material the rats were quickly cured of their rickets.

A previous experimenter had stated that a substance very similar to hemoglobin would cure rickets when the subject treated was exposed to light. In order to determine whether or not light had any influence in the cure caused by the hemoglobin, rachitic rats were fed the diet containing hemoglobin for eight days in a light-proof compartment. There was found to be quite as marked healing as in the presence of light.

Adrenalin, a substance secreted by glands lying immediately above the kidneys, and known to be a very powerful heart stimulant, was next given to the rats. Very weak doses were given at first and the strength of the

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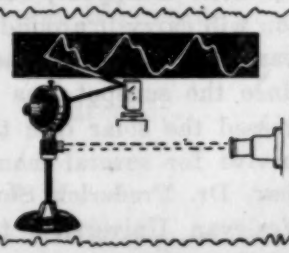

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dose increased until after four or five days the rats were taking at one dose an amount which would have proved fatal before. Healing of the rickets then began and proceeded rather rapidly until all symptoms disappeared.

The third curative substance was found in histamine, which is a decomposition product of proteins, those complex nitrogenous compounds that form the foundation of all living things. Rats on a histamine diet were cured of rickets in from six to eight days.

THE PARATHYROID GLANDS

A CONNECTION between the parathyroid glands, which are located in the neck, and the colon—the largest part of the intestine—is the latest discovery in the study of the important ductless glands, announced by Dr. A. C. Ivy, of Northwestern University.

The parathyroid has been one of the most baffling of the glands. But following the announcement, a year ago, of the preparation of a potent extract of the parathyroids, numerous physiologists have been finding strange regulative actions exerted by these small organs over the functioning of the human body. Moreover, diseases still incompletely understood are being connected with disturbances in parathyroid function.

The usual result of failure of the parathyroid, due to disease in man or produced experimentally in animals, is stiffening of the muscles, and often death. It is known that this stiffening can be relieved by baking soda or by calcium salts. More recently, the newly obtained parathyroid extract has proved effective.

Dr. Ivy outlined his evidence thus: "We removed the entire colon from dogs, and a week or two later the parathyroids were taken out also. In most of the animals the tetany, which usually follows simple parathyroidectomy, did not develop at all." Clinical application has been made of the discovery, Dr. Ivy told *Science Service*. "Colectomy is now being utilized for the treatment of certain mental diseases in humans." This unusual operation, while disagreeable, has already benefited individuals who would otherwise be confined to institutions, despaired of by medical science.

THE MILKY WAY

A HUNDRED years ago the English astronomer, Sir William Herschel, showed that all the stars visible in the heavens formed a system the shape of a watch or a grindstone, with the sun near the center. When we look out along the diameter of the grindstone we see a great mass of stars which appear like a continuous stream of light to the unaided eye. This is the Milky Way, or "Galaxy," as the astronomer calls it; and to learn more of it, and hence of the universe of stars of which the sun and its attendant planets form such a minute part, astronomers at the Harvard College Observatory are engaged in making an extensive series of photographs of these star clouds.

The method used depends on a fact discovered by Dr. Harlow Shapley, director of the observatory, that certain kinds of variable stars, which periodically diminish in brilliance and then grow bright again, change more rapidly, the greater their average brightness. This permits the astronomer to find out how bright they actually are. By looking at them with his telescope he can find out how bright they seem, and from the relation of the actual and apparent magnitudes he can find their distances. These stars, called Cepheid variables, are the ones being employed in the Milky Way studies.

"The Cepheid variable stars, and to a lesser extent the long period variables, afford valuable means of measuring great distances," explains Dr. Shapley. "With the perfection of photometric methods, it becomes possible to analyze any part of the stellar system in which variables occur, outlining its extent in various dimensions and the frequencies of certain types of stars. The problem of the structure of the galactic system has been of special interest to me for several years, and we have now perfected plans to place on a systematic basis one part of the analysis of the Milky Way.

"Three belts in the galaxy are being photographed continually at Cambridge and at our branch station at Arequipa, Peru, with exposures of sufficient length to show stars to the seventeenth magnitude. Each one of the two hundred fields, which completely cover the Milky Way, will be photographed over a period of four or five years from five to forty times annually. The accumulated material will be sufficient, in general, to determine the light variations of all variable stars to the sixteenth magnitude, or fainter. More than a hundred new variable stars have already been found during the early stages of this work. We are particularly able to do this, for we have suitable telescopes and an extensive collection of early photographs, and our staff has had long experience in measuring stellar brightnesses."

The first photographs ever made of stars in the United States were made at the Harvard Observatory in 1850, and ever since the work has been continued so that now the observatory has a file of thousands of plates which are not duplicated at any other institution.

Some of these are direct photographs, others are spectra, which reveal the composition of the stars and which were used in the compilation of the great Henry Draper Catalog. This monumental work lists over 225,000 stars, and gives their brightness, position and spectral type. Most of the work on it was done between 1911 and 1924, largely by Miss Annie Jump Cannon, the first and only woman to receive an honorary degree from Oxford University, in England, which was conferred in honor of her scientific achievement.

SUNSPOTS

THE large sunspot observed by many astronomers, both amateur and professional, during the last few weeks, and visible even to the unaided eye through smoked glass, will soon disappear, for on January 31 the sun's rotation will carry it around the western edge. There is good reason for supposing that it will be seen again, however. Since the sunspot was first seen last November, it has crossed the solar disc three times. Large spots usually survive for several months and sometimes as long as a year, Dr. Frederick Slocum, professor of astronomy at Wesleyan University, told a representative of *Science Service*.

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Professor Slocum has been studying the sun and its activities at the Van Vleck Observatory of Wesleyan University since 1914, when he became director, and before that he made a specialty of solar studies at the Yerkes Observatory of the University of Chicago.

As the sun rotates on its axis once in about 25 to 38 days, a spot is carried across the disc from east to west, but the rotation is not uniform for all parts of the sun. Spots on the solar equator cross the disc most rapidly, indicating that for that part of the sun the rotation period is about 25 days, while near the poles of the sun the rotation is much slower.

"The large spot now visible on the sun crossed the central meridian when it was nearest the center of the disc, as seen from the earth, on December 1, December 28 and January 24. It was on the eastern edge of the sun on January 17, and having crossed the disc, it will pass around the west edge on January 31. This spot is in latitude 22 degrees north on the sun, and the group is 150,000 miles long; the umbra, or dark center, of the main spot being 20,000 miles in diameter, easily visible to the naked eye with smoked glass. Large spots usually last two or three months and occasionally over a year, but smaller spots may last only a few days."

Prominences, the red flames of hydrogen, which shoot out from the sun and are seen at the time of total eclipses of the sun, and at other times with the proper instruments, are related to the spots. When a spot is on the edge, the prominence is seen above it, but Professor Slocum does not believe that the large spot is related to the prominences observed by the Swarthmore College expedition to Sumatra during the eclipse on January 14. There is, however, a smaller group of spots in 20 degrees south latitude which was at the edge of the sun on January 14, and may have caused some of the eclipse prominences.

"The last sunspot maximum occurred in July, 1917," said Professor Slocum, "so if the period is the normal eleven years, the next should occur in 1928. Recent sunspot activity, however, indicates that there will be either an earlier maximum or one of greater intensity than usual."

RECORDING SPEEDOMETER AND AUTOMATIC GEAR SHIFT FOR AUTOMOBILES

An automatic gear box for automobiles that will do away with all manual gear shifts and greatly simplify the art of driving, and a self-recording speedometer that will settle all arguments between supposed speeders and traffic officers are two of the latest Swedish inventions that have been perfected at Gothenburg, Sweden, at the plant of the S. K. F. Company.

The first contrivance is the personal invention of Dr. Sven G. Wingquist, founder of the firm and in 1921 named honorary doctor of engineering at the Stevens Institute of Technology in the United States. Exactly how it is constructed is still a secret, but from various patents granted him during the years he has been working on the problem, it has been inferred that the device utilizes both mechanical and hydraulic principles.

At any rate the new gear box has been installed in a closed motor car of American make and tested out in heavy traffic and under all possible driving conditions. It has also been shown to motor engineers in England, where it has attracted great attention. By automatically throwing into gear more and more wheels as the resistance increases and conversely taking out as the "load" grows less, it leaves the driver free to watch the road and regulate the speed only by means of the gas throttle and brakes which reduce the risk of accidents. It also is supposed to preclude the stalling of the engine.

The self-recording speedometer has been warmly recommended by the Swedish police authorities and for the purpose of testing its workings under various conditions it has recently been installed in five different kinds of vehicles, a taxi cab, a passenger bus, a large freight truck and a light one, and a private automobile. At regular intervals the records of these five motor cars will be inspected by the police and the wear as well as reliability officially determined. Chief of Police Haarleman, of Stockholm, is personally interested in these tests, as he maintains that in the case of accidents it is of the utmost importance to be able to determine exactly how fast each car had been traveling. So far the new speedometer has functioned perfectly in all tests.

ITEMS

Believing that the fossil deposits in the raised reefs of Viti Levu, largest island of the Fiji group, may yield information in regard to its geological history and give science as well a few sidelights on the theory of evolution, Dr. H. S. Ladd, paleontologist and Yale University-Bishop Museum fellow for 1925–26, has left Honolulu for Suva and plans a six-months' stay in the southern archipelago. In addition to the modern reef around the border of Viti Levu, Dr. Ladd points out, there are two other series of elevated coral beds which were deposited in different geological periods and which are believed to have been raised by emergence centuries ago. These contain about 100 feet of fossil deposits. Fossils found in limestone usually consist of fish teeth and shells and it is expected that there will be varieties in the raised reefs of Viti Levu which are not the same as those living to-day.

Dirty-faced stone buildings that blush dark with shame between clean new structures can now be steam-cleaned so that they not merely look almost as good as new, but attain the mellow refined look of ripe age. The U. S. Bureau of Standards has conducted a series of tests to determine the best way of cleaning buildings. Old-fashioned methods of acid cleaning, sand blasting, scrubbing with soap powders and hand brushes are effective, but very slow and laborious. Live steam-cleaning was first tried on dirty stones in the laboratory, and then on a twenty-year-old accumulation of dirt on an old bank building in Baltimore. The results showed that this new method could be used rapidly with inexperienced common labor, although the cost was somewhat higher than for acid cleaning. This cost is expected to drop when the method passes the experimental stage.

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SCIENCE NEWS

Science Service, Washington, D. C.

A SURVEY OF OIL IN ALASKA

OIL in the Arctic is the objective of Dr. Philip S. Smith, of the U. S. Geological Survey, who has just left for Alaska to continue his survey of the government's great oil reserve on the shores of the Arctic Ocean. According to present plans, the party will make a 700-mile trip overland with dog sledges from Nenana, the northern terminal of the Alaska Railroad, to Kotzebue, on an arm of Bering Strait, and thence northeastward across the unexplored Arctic coastal plain and adjacent regions. From April until September they will be wholly out of touch with civilization, and will have to subsist entirely on supplies which they will carry, plus what game the country affords.

"Of course there is oil there," Dr. Smith told a representative of Science Service. "There is a great deal of it, if our explorations during the past two years mean anything. But we must not immediately jump to the conclusion that the Navy is sure of fuel in unlimited supplies. If you will look at the map you will see that there are some very difficult problems to be solved before we can get the oil out.

"Even though the best indications we have found so far are near the sea, it is unlikely that tankers can be used to carry the oil. That part of the Arctic is free of ice for only about one month in the year, and not certainly free even then. Moreover, there are no harbors, and large ships have to lie at least a mile off shore. That would mean an almost impossible job of storage and loading, and would require a whole navy of tank ships.

"I am not intending to throw cold water, however. If we discover oil in large enough quantities to justify it—and that would require very large quantities—the railroad could be pushed through, or a pipe line built. But a pipe line would present problems of its own. The mean annual temperature of that region is only ten above zero, and the line would probably have to be kept heated at frequent intervals, or the oil would become too thick to flow. Fortunately, there is a good deal of bituminous coal up there, so we probably would not have to burn some of the oil to heat the rest. However, all this is speculation as to the future; what we have to do just now is first catch our oil."

According to Dr. Smith, the Arctic slope of Alaska is not a very exciting country. For seventy-five or eighty miles inland from the coast it is flat tundra, more or less marshy and traversed by slow, meandering rivers. Then there is a rise, a sort of low piedmont, sloping up to the foot of the interior mountain range. This region more or less resembles parts of Oklahoma and eastern Colorado, except that the vegetation is dominated by low bushes, mosses and lichens, instead of the grass of the plains states. The principal large game is caribou on the lower levels, and mountain sheep as one gets up into greater altitudes.

AUTOMATIC CODE MESSAGES

IF the code message in Edgar Allan Poe's famous story "The Gold Bug," had been written on the machine described on February 9 to the American Institute of Electrical Engineers, Legrand would not have had such an easy time deciphering it, for the age-old search for a method of putting important messages into a code which can not be interpreted without the use of the key seems to have been achieved.

The new machine was described by G. S. Vernam, engineer of the American Telegraph and Telephone Company who stated that it had been developed for the use of the Signal Corps of the U. S. Army during the war, but until recently it has been kept secret. However, one of the advantages of the device is that even an unauthorized person who has full knowledge of the methods and apparatus used can not interpret the message without the key.

In use, the sender writes the message on a keyboard similar to that of a typewriter, and a perforated tape results which can be used in tape transmitters frequently used in telegraph offices. By means of another kind of machine, if it is desired, the cipher message can be written directly in five-letter code words on paper in ordinary characters. When the message is received, it is written on a tape in perforations, and when this is passed through the deciphering machine, the message is written out in plain text on a sheet of paper.

The method used is one involving what is referred to as a multiple alphabet substitution cipher. In the ordinary substitution cipher a cipher alphabet with the letters arranged in an arbitrary manner replaces the actual alphabet in the same order. That is, instead of starting A, B, C, etc., the cipher alphabet might start F, Q, etc., and in use, the letter A in the original message would become F in the cipher; B would become Q, and so on. Such a cipher may easily be interpreted in the way Poe made famous in "The Gold Bug," by noting the letter that occurs oftenest and calling it E, which is most used in the English language. O is the next oftenest used with T a close third, J, X and Q being the least used.

With the multiple alphabet cipher, a series of cipher alphabets are used one after the other, the order being given by means of the key word, but the same alphabet is used over and over at regular intervals. While more difficult than the single alphabet, the cipher expert, or "cryptanalyst," can interpret such a message without the key. However, if a key as long as the message itself is used and the letters in it are selected at random, it is practically impossible to translate it. This is the system used in the machine, and the key is another tape, so that the transposing of the letters is done automatically.

As a further improvement, a way was found to obviate the use of a tape as long as the tape of the message itself. This was accomplished by using two loops of tape which combined give the key. One loop is one character shorter than the other, so that as the two tapes pass through the

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GEO. M. GRAY,

Curator, Woods Hole, Mass.

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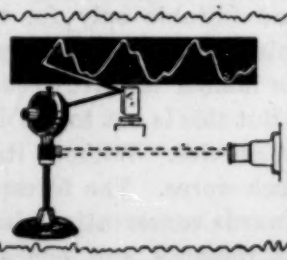

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machine at the same rate of speed, they must go around many times before the same combinations are repeated. This gives the effect of a very long tape.

Mr. Vernam stated that the apparatus could also be used for radio, or if necessary the code tape could be sent by mail without fear of its being interpreted by an unauthorized person.

AN ARTIFICIAL PRODUCT TO REPLACE HISTIDINE

EVIDENCE that the bodies of men and animals are not quite so exacting in their protein food demands as biochemists had supposed is obtained from important experiments in nutrition performed at the University of Illinois, by Drs. William C. Rose and Gerald J. Cox.

The experiments resulted in successful use of an artificial product to replace histidine, which was previously thought to be one of the twenty building stones of protein essential for the growth and development of men and animals.

The fundamental raw materials for the survival, growth and reproduction of animals have been grouped under four heads; sufficient fat or sugars to supply energy for body heat and locomotion; a small amount of metallic salts; accessory substances, known as the vitamins; and nitrogenous materials containing some of each of the 20-odd "amino-acids" of which the proteins are constructed.

Hitherto, animals fed on artificial diets lacking one or more of the amino-acids failed to develop properly. Dr. Rose demonstrated, however, that experimental laboratory animals reached maturity if, instead of histidine, a substance similar but lacking the characteristic amino group, was eaten.

"This is the first time that a synthetic product, devoid of an amino group, successfully replaced histidine," Dr. Rose explained. "Growth, while not so rapid, was decided."

Presumably, the successful substitute, imidazole lactic acid, stole an amino group from other amino-acids in the artificial diet.

The discovery may be of twofold practical significance, it is pointed out. Proteins classed as "incomplete," such as gelatin, which lacks three of the essential amino-acids, may be rendered adequate from the nutritional point of view by the addition of relatively simple compounds. Again, future economic or agricultural conditions may render it expedient to manufacture food proteins, instead of waiting for the process to be carried on naturally by plants. In such an event, the synthetic chemists now know that substances approximating, but not duplicating the natural materials, may be adequate for maintaining the health and functioning of the body.

The report is of particular interest in view of the fact that histidine is a constituent of nearly all common proteins and as such has been regarded as fundamental.

EGYPTIAN COTTON

ALTHOUGH more than half of the world's cotton crop grows on American soil and a third of all the cotton in foreign mills comes out of American gins, American manufacturers get exceedingly nervous if Egyptian planters decide to limit the crop.

The reason is that there is cotton and cotton. The kind that grows under Egypt's desert sun has the longest, finest fibers of any in the world, except the Sea Island cotton which grows in small quantities in the West Indies. American manufacturers like to use it for cord tires and tire fabric, and it is also used in making very fine cotton goods.

The Egyptian Government, which regulates all agriculture, through the simple fact that it can turn off the water in its irrigation canals by a mere twist of the wrist, occasionally deems it advisable to take a tuck or two in the cotton acreage. This has been done at least twice in the last ten years, U. S. Department of Commerce officials say. And now, they claim, restrictions have been proposed for the 1926 crop which will be planted this spring.

A statement of Secretary Hoover to a congressional committee investigating foreign monopolies that control American necessities is as follows: "The motives behind the restriction of acreage may be attributable to one of two reasons, or possibly both. Cotton in Egypt is raised under irrigation depending on the reservoirs of the upper Nile, and from time to time there are shortages of water, and we may consider this the cause. However, there appears to be no such condition existing at the present time, and there is reason to believe that the intention to restrict acreage during the coming season is based upon the desire to influence prices."

Although the United States raises a small amount of Egyptian cotton of its own in Arizona and California, it has not been as popular as the imported kind. Spinners claimed the American long staple or pima cotton could not be worked as well because it was not as carefully handled as that from Egypt. At any rate the demand tapered off, and the production of pima cotton dwindled from over ninety thousand bales in 1920 to about four thousand in 1924.

There is no real reason why the United States should be dependent on Egypt for this product, in case of need. The climate and length of season in Arizona is very much as it is in Egypt. It is a question of labor, and of prices. Pima cotton costs more to produce as it requires greater care. Egypt has cheap labor and can compete successfully in spite of transportation rates.

IDLE TIMBER LAND

DESPITE the efforts of the U. S. Government in the past half century to encourage forests, 81 million acres of land suitable only for timber growth is now lying idle. This denuded area, moreover, is chiefly in the East where the lumber is most needed for manufactures.

But this is not to the discredit of the United States Forest Service. Without its aid, the figure would have been much worse. The forestry service has taken great strides towards conservation since Dr. Franklin B. Hough began his research and educational program of reforestation

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and protection in 1876, the semicentennial of which will be celebrated this year.

A half-century ago there were no government-owned forests set aside for conservation. To-day 21 per cent. of the 470 million acres of forest land in the United States is owned by the public—nation, state or municipality—reports William B. Greeley, chief forester.

We use forest products in such a multiplicity of ways that they are a great drain upon our forests—in pencils, paper, turpentine, rosin, soap, shoes, automobiles, boats and even in artificial silk. As the population goes uphill our forests go downhill. Four times as fast as the forests can be replenished, they are being depleted. Two hundred and fifty million trees of average size are cut every year, or an area equal to Massachusetts, Connecticut and New Jersey put together. A large amount of this lumber is used by newspapers, for it takes 16 acres of spruce trees to make the paper for one Sunday edition of a metropolitan newspaper.

Mr. Greeley sees as one help to the situation the making of forestry a part of diversified agriculture, that is, forest planting on farms and the practical instruction of farmers in forestry. Already 150 million acres of forest land —nearly one third the total for the entire country—is in farm holdings. Fifteen states now maintain forest nurseries from which small trees are furnished at nominal cost to farmers and other landowners desiring to plant them.

ITEMS

ANOTHER gap in the spectrum of radiation, which includes light, X-rays, radio waves and the very short rays investigated by Millikan, has now been filled, it was announced recently by Wynn Williams, of the University of North Wales. He has been making investigations of sparking between electrodes and accidentally found the new rays, which are believed to fill part of the gap between the longer X-rays and the short ultra-violet rays, which lie beyond the violet and the visible spectrum. It is stated that the new rays will penetrate air for several meters and will go through thin celluloid films, but are stopped by solids such as gold leaf and even thin mica.

TEN prehistoric stone tombs containing richly sculptured copper ornaments and plates, together with traces of beautiful feather mantles, woven fabrics and matting preserved by contact with the copper, have been unearthed from an ancient Indian mound near Cartersville, Georgia, by the Department of Archaeology of Phillips Academy. Two of these sarcophagi, made of neatly fitted thin limestone slabs, have been received by the Andover Museum and will be set in earth and the objects taken from them replaced within them as found. The explored mound is part of the famous group of eleven mounds, situated on the Etowah River and supposed to be part of an ancient large Cherokee town where Ferdinand De Soto, the Spanish explorer, fought with the Indians. There is no trace of Spanish influence, however, in the 2,000 implements of stone and clay, the 4,000 beads, or the copper plates and other objects uncovered. Twenty burials were found, ten of which resembled tombs rather than the ordinary stone slab burial graves commonly found. In some of these, large fragments of copper plates remained, and the salts in the copper through oxidation preserved traces of the hair, fabrics in which the bodies were clothed and even traces of feather mantles, and some matting.

LIGHT without heat, long an ideal of scientists, is achieved by a plant which shines in the dark, the fungus known to botanists as *Agaricus melleus*, and sometimes found in decaying wood. This efficient organism was described in a paper presented before the Optical Society of America by Dr. W. W. Coblentz and C. W. Hughes, of the U. S. Bureau of Standards. In the course of their study of the kind of light given out by this fungus, commonly called "fox-fire," and also that of a small shellfish called *Cypridina*, which likewise shines in the dark, photographs were made with a spectroscope, which analyzes the light. It was found that the illumination from the fungus was just within the limits to which the eye is sensitive. It did not contain any of the longer heat waves, or the shorter ultra-violet waves, which are present in sunlight, though they can not be seen by the eye. The spectrum of the luminous shellfish was similar, but did not contain so much red light, while that of the firefly, it was stated, contains little blue or red, and is mostly yellowish.

"NEOCYANIN," a new dye recently developed in the research laboratory of the Eastman Kodak Company, may prove valuable to astronomers in photographing heavenly bodies by the long invisible infra-red rays, says Dr. C. E. K. Mees, director of the laboratory. The ordinary photographic plate is sensitive only to blue light and the shorter and invisible ultra-violet rays, but by bathing the plate with certain dyes before exposure, they become sensitive to light of approximately the same color as the dye used. Orthochromatic plates and films are thus treated and become sensitive to yellow light, but the new dye makes them sensitive to light waves as long as one twenty-two thousandths of an inch, while the longest rays visible to the eye are about one thirty thousandths of an inch in length. Plates bathed with the new dye are expected to prove especially useful in spectroscopy, for photographs made through the spectroscope show many light and dark lines which to the astronomer reveal the star's pedigree and character. Many of these lines occur in the invisible infra-red region of the spectrum and photographs made by the new plates will help give a more accurate idea of the star's nature. Modern astronomers use the photographic plate almost exclusively, instead of observing the heavenly bodies directly through their telescopes.

A COOK STOVE built by the National Geographic Expedition to Mt. Katmai five years ago was found and used by an explorer last fall. It was as hot as ever and cooked food perfectly, without fuel or smoke. The stove is a two-foot hole dug out of a boiling fumarole of steam in the valley where over a thousand of the steaming pot holes are located. The discovery of this cook hole and its identifying mark proves that the volcanic regions about Mt. Katmai are not cooling to a perceptible degree.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE BENDING OF RADIO WAVES

BENDING of the radio waves in the upper atmosphere, in somewhat the same way as a beam of light is bent when crossing a hot stove or highly heated ground, is responsible for many of the curious and apparently contradictory effects observed in radio transmission with short waves, according to William G. Baker and Chester W. Rice, of the research laboratory of the General Electric Company at Schenectady, N. Y. Just as the bending of light waves over a desert sometimes brings into view objects far beyond the horizon, and produces a mirage, when the radio waves are bent it may be possible to hear signals from a distant station though nearer receiving sets can not detect them.

"Experiments in short-wave (*i.e.*, 60 to 15 meters) transmission made during the past two years have definitely brought to light many peculiarities which were entirely unexpected as extensions from our many years of long-wave experience," said Mr. Baker. "Until recently any announcement of long-distance short-wave transmission was put down as an unexplained freak by the average radio man, and dismissed from his mind. As the number of such reports increased, we could no longer be content to dismiss them as freaks. We were forced to abandon our preconceived notions as to what normal short-wave transmission should be.

"As a typical example of the peculiarities of short-wave transmission, let us describe the experience obtained with a 5 kw., 30 meter transmitter. Here the signal strength rapidly decreases as we leave the transmitter and reaches the lower useful limit at about 70 miles. This short range is what might be called the unexpected value as viewed from our long-wave experience. If now we continue to greater distances the signal remains out until we reach approximately 450 miles where the day signal unexpectedly becomes strong again.

"Continuing to greater distances we find the signal gradually falling off in intensity and reaching the limit in the vicinity of 4,500 miles by day. On a summer night the signal does not reappear after the 70 mile extinction until we are approximately 2,000 miles from the transmitter, after which the signal falls off gradually to a very low value at 7,500 miles."

These effects, which vary in amount according to the wave length and power of the transmitting station, are explained by the investigators as being due to the presence high up in the atmosphere of a layer of free electrons, of which the atoms of matter are supposed to be made. Near-by receiving sets hear the transmitting station by the direct waves as these go out in all directions from the aerial, but these waves that rise in the air enter this electron layer, and are refracted so that they are bent downwards again. However, the waves which ascend almost or entirely vertically are not refracted, and so are not brought back to the earth, and the 450 mile day limit represents the line reached by the waves which have just been far enough from the vertical to be refracted. At night time the layer of free electrons is at a greater altitude and so the nearest return of the "sky wave," as it is termed, is farther than in the day.

Fading, the bane of the broadcast listener's existence, may be caused when the sky wave comes back to earth within the limit of the ground wave, causing interference between the two. However, as the work of Mr. Baker and Mr. Rice has discovered some of the laws which govern the short waves, it may now be possible to design sets which will give the best transmission between two particular points.

LOSS OF LIFE FROM VOLCANOES

PRECAUTIONARY measures to prevent loss of life from volcanic disaster are being urged by European scientists.

In a paper published by the Geographical Society of Geneva, Dr. Albert Brun stresses close scientific observation of all the phenomena attending active volcanoes as the best means of guarding against catastrophe. He mentions the study of earthquakes at the volcanoes, registration of sound waves, chemical analysis of gas, use of aviators for reconnoitering and the steady observation of the performances of craters and hot springs as necessary means of being forewarned for trouble.

Dr. Karl Sapper, of the University of Wurzburg, maintains, on the other hand, that the disturbances characteristic of active volcanoes, such as appearance of new vents, underground noises, earth tremors, exhalation of gas and the like are not sufficient evidence of a coming eruption. He cites Cotopaxi, Kilauea, Keloet and others as eruptions that have broken out without any such advance warnings. 190,000 people have been killed by volcanoes in the last four centuries, he says, 93 per cent. of which were about the Pacific, the maximum loss having occurred at volcanoes erupting only once with much violence and after a period of long inactivity.

Dr. Sapper advocates as the most effective method of attack popular propaganda and education of the public in the schools concerning precautions, building sites, steep roofs to shed ash and readiness to migrate in case of danger. Valley bottoms, the natural paths of the lava flows, should be avoided as places in which to settle. Governmental insurance reserves and rehabilitation are the only means of meeting the emergency of famine and disease, caused by the heavy fall of ash, destructive to plant and animal life alike.

Already some results of the progress in knowledge and education about volcanology have been seen in the handling of the Vesuvius and Etna eruptions. Still better preparation and protection were in evidence at Sakurajima in Japan. Java and Hawaii have cared for disasters with science and forethought and many of the countries which have active volcanoes within their confines are devoting attention to careful building, transportation and organization for crisis, as never before.

THE HIGHER APES

JUST where the higher apes belong on the zoological family tree, and exactly what names we have a right to call these hairy cousins, has been the subject of an ex-

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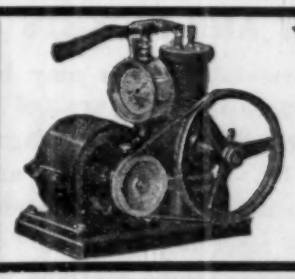

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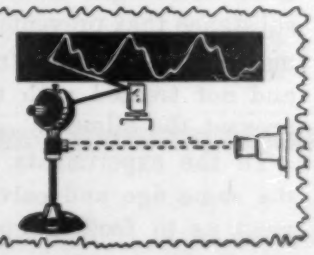

haustive study by Dr. C. W. Stiles, of the U. S. Public Health Service, who has just completed a 150-page treatise on the subject for early publication.

"This may look like a question of interest only to professors of zoology," said Dr. Stiles, "but the exact opposite is the case. The study was undertaken in the first place because of its very great practical importance. Apes and monkeys are indispensable now-a-days in the experimental study of human diseases, and a great deal of confusion and some possibly dangerous mistakes can be caused in medical and bacteriological circles when the same name is given by different men to entirely distinct species of apes, one of which might be very susceptible to a given disease and the other quite immune. So a straightening up of the whole situation was necessary, if we are really to know what we are talking about.

"My survey of the literature on apes and monkeys took me back to the year 1551," Dr. Stiles continued. "The confusion of names began then, and it has not been straightened out yet. Not merely apes but the human species also were involved by the earlier writers, who lived long before Darwin and so far as I know never gave a thought to evolution. Some of them listed apes as a kind of man, others considered certain types of men as apes. Even as late as 1829, a freak human being who was discovered was classified as an ape.

"One interesting side-light on this situation is afforded by the name of the big East Indian ape, the orang-utan. 'Orang' is a Malay word meaning 'intelligent being'; it is applied not only to man and the orang-utan, but also to the elephant. Roughly, it may be said to mean 'man.' 'Utan' means 'of the woods.' 'Orang-utan' therefore means 'man of the woods.' One early scientific name of the orang-utan was a literal translation of the Malay into Latin: 'Homo sylvestris.' A later but only slightly freer translation was made by P. T. Barnum, *i.e.*, as 'the wild man of Borneo.'"

In order to end the confusion of names among these animals, Dr. Stiles has decided to cut the Gordian knot, and instead of trying to determine exactly which ones among the many names that have been given to them should be applied to the various species, he will appeal to the International Committee on Zoological Nomenclature to authorize the use of names on which no conflict in use exists.

ULTRA-VIOLET LIGHT AND RICKETS

BATTERIES of quartz-tube ultra-violet lamps may become a necessity in stables where dairy cattle are fed in winter, if the experiments performed at the Maine Agricultural Experiment Station by Dr. John W. Gowen and his associates may be taken as an indication. The experiments show that milk from cows receiving a "dose" of ultra-violet light from mercury vapor lamps contains the substance that prevents rickets in children and young animals, while the milk from cows kept away from sunlight and not treated with ultra-violet light was powerless to prevent the ailment.

In the experiments, Holstein-Friesian cows of nearly the same age and calving date and receiving like treatment as to feed, temperature, etc., were placed side by side in the same barn.

"Throughout the experiment these cows did not leave the barn. For one month none of the cows received ultra-violet light. For the second month two cows received ultra-violet light fifteen minutes a day generated from a Cooper-Hewitt alternating current light at three feet above their backs. For the third month these cows received ultra-violet light for thirty minutes a day under the same conditions. In the meantime Rhode Island Red chickens were allowed to develop rickets, shown both clinically and by X-ray photographs. They were divided into two lots, one lot of these chickens receiving milk from the ultra-violet cows, the other of two chickens, milk from the control cows. Both lots received all the milk they wished.

"The chickens have now been under treatment fifty days," Dr. Gowen states. "The lot receiving milk from cows exposed to ultra-violet light are in good condition with no appearance of rickets in X-ray plates. The lot receiving normal milk has moved progressively toward more extreme clinical and X-ray rickets. The experiment has been repeated, using the milk from these same cows on White Leghorn chickens showing clinical and X-ray rickets. Five chickens were in each lot. After thirty-eight days' treatment four of the lot receiving milk from the ultra-violet cows are almost cured of rickets, showing only a very slight stiffness. The fifth chicken shows same stiffness. Four of the lot receiving the normal milk show constantly increasing symptoms of the more advanced stages of clinical rickets.

"These results point to the conclusion that more of the substance necessary to cure rickets is absorbed by the cow exposed to ultra-violet light and secreted by her in her milk. The cows prevented from receiving ultra-violet light are not able to secrete this anti-rachitic substance in sufficient quantities to cure or allay the progress of clinical rickets. The results thus point to an environmental factor transmitted by the cow to her offspring through the medium of her milk. It further suggests that the high incidence of rickets in children during the late winter months is due to their mothers' not receiving ultra-violet light either during pregnancy or while in lactation. Furthermore, it would appear that cows' milk produced especially for baby-feeding should be from cows which have access to ultra-violet light either from the sun or some other source."

THE FUNCTION OF THE SPLEEN

MODERN medical science is at last unraveling that physiological mystery of the ages, the purpose of the spleen in the human system.

It has been known since classical times that the spleen could be removed without any apparent ill effects on the patient. Various conjectures, all more or less erroneous as to what its purpose could be in the human anatomy, have come down to us. By the last half of the nineteenth century it was definitely established that it had something to do with the purification of the blood as well as the formation of some of the blood cells, and though it was not necessary for life these functions after removal were taken over by the bone marrow and other organs.

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mysterious organ, by Dr. E. B. Krumbhaar, of Philadelphia, we find that the spleen is an important source of antibodies, those little-understood elements in the blood that help kill off bacteria. Laboratory experiments seem to show that the spleen plays a considerable part in resistance to such infections as tuberculosis and also to the growth of tumors. It has been found that tumor grafts make much less growth in the spleen than in any other organ, and that its removal definitely cuts down the resistance to tumor inoculation. Some experimenters believe that it contains a substance actually destructive to tumor cells, but this has not yet been conclusively proved.

Two doctors of New York City, Dr. S. Shapiro and Dr. F. H. Frankel, have tried to ascertain the effect of feeding extracts of spleen and bone marrow upon the formation of red corpuscles. Their patients showed an increase in the number of red cells while being fed the extract, but the count went down as soon as the dose was stopped. The definite establishment of the fact that such extracts contain a substance which will increase the production of red corpuscles would be of inestimable value in the treatment of many diseases, particularly anemia.

INFLUENZA AND PNEUMONIA

THE world has been afflicted with an unusual amount of influenza and pneumonia during the last six months. While medical authorities will not predict an epidemic like the one of 1918, they admit its possibility.

Three factors make an influenza epidemic a grave contingency: first, its apparently cyclic character; second, the coal strike; third, lack of knowledge with respect to its control.

Cyclic character means that it is likely to come back again and this is demonstrated by study of its previous occurrence. The big influenza epidemics of the past, notably in 1889 and 1918, have been characterized by recurring waves in the succeeding years. After about 1894, unfortunately, influenza faded out of public attention, until by 1918 much valuable knowledge acquired in the earlier epidemic has been forgotten. Dr. Victor C. Vaughan, of the National Research Council, has expressed himself, in a recent talk, as of the opinion that the present outbreak is a secondary wave of this sort.

Many have attributed the increase of influenza to the scarcity and inferiority of the fuel supply though this hardly accounts for its presence in the countries that have not been in the throes of a coal strike. Insufficient heat, while it may not be a cause, has undoubtedly been an aid and abetment in the current prevalence of both influenza and pneumonia.

It is discouraging to learn that years of research will probably be necessary to give the world information as to the best means of combatting this potential plague. Another epidemic would find the medical profession quite as impotent to deal with it as in 1918, according to Dr. Vaughan. Its causative agent is unknown. A vast amount of bacteriological work has been done on the subject but medical science can not come to any definite conclusions concerning the agent that really produces plain unadulterated influenza. The complications such as bronchitis and pneumonia that frequently follow have rendered isolation of the organism causing primary influenza particularly difficult. Various vaccines in use as a safeguard have met with nearly as much failure as success.

The best preventive measure, impractical as it sounds, when influenza assumes any very serious proportions, is to keep in the best physical condition possible, and to stay away from crowds. In other words, the best way not to get it is to avoid it.

ITEMS

A MACHINE which pours ultra-violet light through a funnel down the throat of a patient has been on display in London, at a nursing exhibition, and has attracted considerable interest. Both sunlight and ultra-violet light, or artificial sunlight, are in general use for external treatment of rickets, tuberculosis and some other diseases. Light rays are also being applied to hasten healing wounds. The new apparatus is being used for treatment of various mouth and throat diseases, thus making it possible for patients to take internal baths of artificial sunlight.

BED rest instead of physical exercise, and deep exhaling from the lungs, in addition to the usual non-fattening diet, are prescribed as a cure for obesity by Dr. G. Leven, general secretary of the Paris Therapeutic Society. Dr. Leven teaches his patients to breathe out so hard that they bend the flame of a candle, and to inhale only very slightly. The breathing can be done lying in bed, sitting up or standing erect. Series of five exhalations are repeated every half hour fifteen to twenty times a day. One patient lost fifteen pounds in twenty days and another sixty pounds in the course of eight months. When a person overeats, Dr. Leven believes, the solar plexus is irritated and this disturbs the functioning of those cerebral centers that regulate the destruction of fat. Other conditions may also cause this disturbance. The course of treatment prescribed is claimed to counteract the effect.

THE French have a new fireproof building material. It is cheap, light, durable, sound proof and made of straw. The straw is pressed into rectangular panels nine feet long by six feet wide and two inches thick, bound together by lengthwise wires about six inches apart. The heavy pressure under which the panels are constructed as well as the mineral content of the straw account for its being fireproof. Solomite, as it is called, was used extensively last summer on account of its easy handling properties in the construction of many of the buildings of the Exposition of Decorative Arts at Paris. It has been found to work out very well as side walls, ceilings and partitions, offering a convenient surface for plaster and stucco. This type of construction has proved to be very popular for summer cottages, while the sound-proof qualities of the material have rendered it useful in the audition rooms of music stores.

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Owing to an extensive building program about to be inaugurated at the Hospital and Medical School, it has been deemed necessary to withdraw, for the next two years at least, post-graduate instruction during the year as well as the summer course formerly given during June and July.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE BLISTER RUST AND THE SUGAR PINE

THE blister rust which has wrought such havoc with the white pines of the East is less than two hundred miles from the great sugar-pine forests of Oregon and California. The western white pine and sugar pine are among the most valuable timber trees of the West, and the federal government, itself a large owner of these species in the national forests, is vitally concerned in their preservation from the pest.

S. B. Detweiler, in charge of the office of blister rust control, U. S. Department of Agriculture, stated that recent advances of the rust while greatly to be regretted were inevitable. The continued spread of the disease is to be expected until it reaches the limits of white-pine growth, but while it can not be prevented it can be materially slowed down.

The Bureau of Plant Industry has had under way a program of local control in the East since 1922. Through the cooperation of state forestry officials and state extension agents efficient measures have been in operation that have cut down appreciably the loss in the white pine forests of New York and New England.

Curiously enough, this parasitic menace of the white pine is eradicated by uprooting currant and gooseberry bushes in the neighborhood of the pine timber stands. The blister rust is a fungus with a complicated life history, part of which is spent on the leaves of the botanical genus Ribes, a group which takes in all the cultivated and wild currants and gooseberries. It can not spread from tree to tree like chestnut blight, but has to go from the pine to the leaves of the currant or gooseberry; and this gives the forester the means of control. Trees can not be conveniently rooted up but bushes can; so all the currants and gooseberries must be eliminated, particularly the cultivated black currant, which has proved to be a host *par excellence* for rust spores from pine trees even as far away as a mile. For while the spores from pine trees can not infect other pine trees the ones from currants can infect other currants so that the disease spreads rapidly through a whole patch, thus materially increasing the radius of the spores. The blister rust control agents, with the assistance of state and county officials as well as the general public, are clearing about a million acres of black currants a year in the forest regions of the Northeast.

The blister rust first reached the West at Vancouver, B. C., in a shipment of pine seedlings from France. It was discovered by forest officials in Washington and British Columbia in 1921 and in Oregon in 1922. By 1924 a program was under way to keep it under control, in which federal and state officials as well as private interests were coordinated.

The vast acreage of western forests, running into millions, made the problem much more difficult than in the East. The first step was to put into effect a rigid quarantine to prohibit any of the host plants of the rust being shipped into the West. Next a systematic effort was made to eradicate completely the black currant from the states of Montana, Washington, Idaho, Oregon and California. Through this foresight it is hoped to cut down the chances of infection before it can make any very damaging spread in these states. Already the end of 1925 has seen Idaho and Oregon practically clear of dangerous black currants.

Effective control work can only be done before the trees are seriously attacked. In consequence a general campaign is under way to educate the people in the knowledge that if the timber is to be saved the currants and gooseberry bushes must go.

WINGED TREE SEEDS

THAT the winged seeds of the Douglas fir, principal timber tree of the Northwest, can travel surprising distances in even a moderate wind has been demonstrated by an experiment performed by the foresters of the Pacific Northwest Experiment Station at Pearson flying field at Vancouver. This test yielded data of value in determining the number of trees which should be left for reseeding purposes when an area is cleared of its timber.

In the experiment, a box kite carrying a carton of Douglas fir seed was sent up in an eight-mile wind, and when it had reached the height of a full-grown cone-bearing tree the seeds were released by a suitable mechanism. Observers stationed by canvas sheets spread on the ground at various distances down the wind watched the flight of the seeds, and counted the numbers falling on their sheets, from which the number of falling seeds per acre were calculated.

The winged seeds, their downward flight retarded by the spinning motion given them by their wings, formed a tiny cloud which floated down the wind taking a direct and narrow course, relatively few falling for several hundred feet. The catch on the canvas on the 600-foot line showed a seed-fall at the rate of 250 winged seed to the acre. At 850 feet it has increased to 40,000, and at 1,100 feet out from the kite, 302 seed fell on a canvas 11 by 15 feet, or at the maximum rate of 80,000 seed to the acre. The most distant line of canvases, 1,600 feet out, showed that the fall had again decreased to 250 to the acre. Some seed traveled a considerable distance beyond this point as men stationed at the last canvas saw seed still several feet in the air passing them.

OYSTER CULTURE

"BACK to nature" is the slogan of the experts who are trying to coax the oyster back to its old-time productivity. Oysters live, thrive, increase and multiply best in the brackish waters of our coastal estuaries and harbors, according to H. F. Prytherch, of the U. S. Bureau of Fisheries. At the experimental shellfish laboratories at Milford Harbor, Conn., experiments have been made to determine if oysters can not be induced to become as plentiful in their native haunts along the New England

Biographical Directory of American Men of Science

FOURTH EDITION

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Membership in scientific societies and offices with dates at which they were held

Chief subjects in which research work has been published or is now in progress

coast as they were in the days of Massasoit and Miles Standish.

The oyster spawn is microscopic in size and for two weeks exists in a free swimming larval state carried hither and thither by the waves and the tide. The great keynote of oyster culture is to get the largest number possible of the baby oysters to "set" upon some stationary object at the end of the free-swimming stage. Once set the oysters can not move of themselves. The full grown marketable adults can readily be collected from whatever planted material, usually old oyster shells, have been used to catch the young ones or "spat."

At Milford Harbor for the past four years many experiments have been carried out in the study of the life history of the oyster, particularly the free-swimming stage. Very few larvae are found in the water in the interval between spawning and the time for them to set. The investigations this summer show that the larva lives part of the time on the bottom during this period, pulling itself along by means of a muscular foot, like a clam. This interesting discovery has enabled investigators to understand much better the relationship of spawning beds and setting areas and the effect of tides and currents on distribution.

Rocks, shells, glazed tile and objects of many sorts were tried out as collectors for the "spat." Birch brush, bearing dozens of tiny oysters planted in rows in the tidal flats, presented the aspect of what might be called an oyster garden. The outstanding results of the summer's work show that millions of seed oysters can be produced when natural conditions of breeding are reproduced. Protection of these inshore areas is essential if the oyster is to continue to be a delicacy of the American table.

Thousands of dollars have been spent by commercial enterprises sowing oyster shells to collect seed oysters, with steadily decreasing results. In years past when the oyster industry had been successful in obtaining yearly crops of oysters there were large natural beds located in the harbors, bays and river mouths where the conditions were favorable for the production of a vast quantity of spawn. To-day these valuable areas have been destroyed by excessive pollution from factories and by overfishing so that only the deep water beds remain for the production of seed oysters.

When spring and summer weather conditions in deep beds resemble those normally existing in the harbors and estuaries, oyster culture is successful, but unfortunately this happens only occasionally. Connecticut recently passed a law enforcing the control and elimination of pollution in its harbors. The enactment and enforcement of such legislation in other oyster-growing states would do more than any other one thing to increase the existing supply of oysters. This spring the Bureau of Fisheries intends to undertake an investigation of the coast of South Carolina to ascertain the possibilities for oyster propagation in the South. A similar survey of Texas is already under way.

BLOOD TESTS FOR WHOOPING COUGH

Dr. C. F. Powers, of the Yale Medical School, has ascertained by chemical examination that the calcium content of the blood of patients suffering from severe cases of whooping cough is very low. This he remedies by administering calcium chloride. He also advocates applications of radiant energy or X-rays for what he calls the electrical hyperirritability of the nerves or convulsions. These are measures for bad cases that are complicated by a previous condition of rickets, but even for children with the more moderate form of the disease without complications, Dr. Powers recommends X-rays.

Ether is occasionally resorted to to quiet the more violent paroxysms, while for all degrees of whooping cough the best all round remedy is codliver oil, because it helps build up against the condition of malnutrition that often persists till long after the last final whoop.

Dr. J. C. Regan and Dr. A. V. Tolstoouhov, of Brooklyn, have found in making chemical analyses of the blood of whooping-cough patients that the hydrogen ion concentration, that is, the acidity of the blood, is greatly lessened in proportion to the severity of the disease. They also noted a considerable decrease in the amount of phosphorus. Just what use can be made of the knowledge of these interesting changes is not yet determined.

Physicians who specialize in the diseases of children use a blood test in diagnosing doubtful cases. It consists of counting the number of white-blood cells which increase greatly if whooping cough is really present. It is not certain, but is often of great assistance when considered in connection with other symptoms, for it is very important to keep even the mild cases isolated so that they may not infect other children.

HORTICULTURAL ART OF THE ANCIENT MEXICANS

Not only the gardens of Montezuma, but the picture writing of his subjects prove the ancient Mexicans to have been great horticulturists. Their descendants still use their complex system of botanical names, a system which conveys information as to qualities, characteristics and habitat of many plants.

Wilson Popenoe, formerly of the U. S. Department of Agriculture, in a paper on "Plants of Aztec Picture Writing" gives a long list of botanical figures used in Aztecan hieroglyphics. The flower symbol recurs constantly in all sorts of combinations as a place name. Maize, an important feature in all Indian life, appears frequently along with the sweet potato, the black bean, the cherry, plum, avocado and various less known native fruits. Most interesting is a combination of the water sign with the conventionalized sign for cultivated ground meaning "place where the land is irrigated." The familiar desert features, the yucca, the cactus and the mesquite, are all represented, but the gem of Mr. Popenoe's collection is the picture symbol which directly translated means "flea pepper," a fitting name for the biting, red hot pepper of the southwest.

The floating gardens of Mexico City, so famous during the conquest, may still be considered one of the best expressions of the native horticultural art. Willow trees are planted in the shallow water of Lake Xochimilcho in plots varying from 200 to 2,000 square feet. Their interlacing roots form a sort of basketwork that holds the soil with which the plots are filled while their tops are

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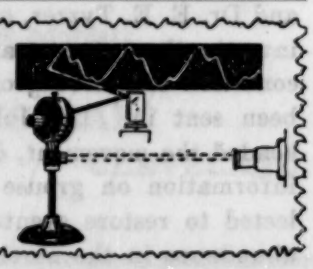

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EVOLUTIONARY EVIDENCE HIDDEN IN HUMAN VEINS

HIDDEN away in the interior of man's veins are indications that his ancestors once walked in a stooping position, according to Dr. C. W. Stiles, of the U. S. Public Health Service.

In the veins of human beings, as well as of the lower animals, Dr. Stiles stated, there are numerous little check-valves, that relieve the back-pressure of the blood and prevent it from flowing the wrong way. In all cases in animals, these valves are found in veins where the blood commonly flows "uphill" toward the heart, as in the veins of the legs and arms. In animals the blood must flow "uphill" also in the veins that lie beneath the ribs, since the animals carry the trunk of the body horizontally and the ribs therefore hang vertically. But in the veins that run horizontally, notably the great trunk vein that runs along beneath the backbone, no valves are needed to prevent back pressure, and none are found in this position.

In man, however, the trunk is carried vertically, so that the relative positions of the veins are exactly opposite to those in the animals, the rib-veins being horizontal instead of vertical and the great vein of the back being vertical instead of horizontal. Yet the valves in human veins follow the same pattern as do the valves in animal veins. They are found in the rib veins where they are not needed and are absent from the great dorsal vein where they would be really useful. This is understandable on a theory of ancestral survivals in man, but is completely contrary to a special-creation theory which assumes that the body of man is perfectly adapted for his present mode of life and made without any useless parts or any mistakes.

ITEMS

ELECTRIC light bulbs are not the only things that contain argon. This supposedly rare inert gaseous element has lately been discovered in the cells of a number of organisms, and is presumably present in the cells of all living things. A French scientist, A. Pictet, reported recently before the Paris Academy of Sciences that he and two associates had extracted a little less than a third of a cubic centimeter of the gas from a gram of dried yeast, and that they had later found it also in sheeps' brains and in the blood of oxen. They explain its presence on the hypothesis that the gas, being exceedingly inactive chemically, slowly accumulates in the cells as it is carried there, and has no means of elimination because it does not combine with other elements. It thus remains stored in the cells until their death and disintegration.

COUNTRY doctors can now send a specimen of a patient's blood through the mail and have it correctly analyzed in the most up to date metropolitan laboratories hundreds of miles away. Dr. Henry J. John, of the Cleve... Clinic, in a forthcoming issue of *Archives of Pathol...* describes a vacuum tube for collecting and preser... blood samples. It will hold about one and a half c... inches of blood and contains a small quantity of a d... fluoride thymol, in the form of a powder, which prev... the blood from clotting and preserves it in the origi... condition in which it was taken from the patient. T... tube is easily used and will doubtless prove of great v... not only to the practitioners who do not have access t... laboratory, but to insurance companies, many of wh... are now requesting blood sugar tests of applicants ... policies.

IT comes as a surprise to the world at large, wh... does not think of England as an agricultural country, ... realize that it is spending annually over $670,000 ... further agricultural research. An extensive system ... in operation with plans for still greater building to br... scientific knowledge and methods directly to the aid ... the English farmer. Over $70,000 yearly go to ... maintenance of advisory centers to provide for inve... gation of purely local problems. The farmers themsel... are keenly interested and night schools and "discuss... societies" are a great success and flourish in increas... numbers. Poultry raising and various branches of ho... culture have made great advances while the whole da... industry has taken huge strides forward as the adv... tages of pure bred stock have been apparent to ... dairyman. The Ministry of Agriculture has been mak... grants to the agricultural departments of various colle... for extension work. The government is making seri... efforts at efficient coordination of the whole enterpr... for it is generally felt that the back-to-the-land mo... ment holds great promise economically for Englan... future.

RADIO is being used to help save the ruffed gro... from extinction. This once common game bird, ... loquially known as partridge, has been gradually dis... pearing from our northern woods for years in spite ... attempts of state game associations to restock the sup... Experts have ascribed this decline to various paras... and several diseases, but very little is known as to th... true nature. By radio the general public was asked ... bring in any dead or wounded birds, so that scienti... could study them and determine the cause of th... scarcity. Thornton W. Burgess, of Peter Rabbit fa... from WBZ appealed to thousands of members of ... Radio Nature League, scattered throughout New Engl... and Canada, for their cooperation with the results tha... steady stream of specimens has been pouring in. Th... are being turned over to Dr. A. O. Gross, of Bowd... College, Maine; Dr. A. A. Allen, at Cornell Univers... and Dr. E. E. Tyzzer, of the Harvard Medical School, ... investigation. Important information on the number ... condition of ruffed grouse over a wide territory has ... been sent in. Dr. John C. Phillips, of Harvard, w... headed the movement, declared there is hope that enou... information on grouse habits and diseases will be ... lected to restore eventually the ruffed grouse to nor... abundance in the northern states.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE SEMI-CENTENNIAL OF THE TELEPHONE

"MR. WATSON, please come here, I want you." Fifty years ago, on March 10, this sentence was uttered in an attic room in Boston, and the voice of the speaker was heard in a telephone in an adjoining room. To people living in 1926, this would be a trivial incident, but then it was one of the most epoch-making sentences ever spoken. For the speaker was Alexander Graham Bell, and these were the first spoken words in the world's history to be transmitted over a wire.

This result was not due to any accident, however, for it was nearly a year before this that Bell and his assistant, Thomas A. Watson, had succeeded in transmitting the first musical sound—the simple twang of a clock spring—over a wire. With this achievement, the fundamental principles of the telephone had been mastered, but many weeks of work were necessary before the instrument would talk.

Even with the perfection of the telephone as an instrument actually capable of transmitting speech, commercial success did not immediately follow. At first, the telephone was regarded as a scientific toy, incapable of any practical use, but the Centennial Exposition held in Philadelphia in 1876 was the means of bringing it before the public. But even here, where Bell first exhibited it, it attracted only casual attention until Dom Pedro, then Emperor of Brazil, whom Bell had met many years before, had it demonstrated to him. "My God, it talks!" the emperor is said to have exclaimed. This attracted the judges' attention, and Bell's exhibit was soon one of the features of the exposition.

Even then, it was a long pull to put the telephone to commercial use, and it was not until May of the following year that the first commercial line was established. By August, 778 crude instruments were in use—a striking contrast to the 16,000,000 in use to-day.

When the success of the invention was finally assured, development became rapid, and spread over the country and the world. In 1892, Dr. Bell spoke from New York to Chicago. In 1915, into a replica of his original instrument, he again spoke the words which summoned Mr. Watson in 1876, but he replied: "It would take me a week now," for he was in San Francisco, and Dr. Bell in New York.

ARCTIC EXPLORATIONS AND THE ORIGIN OF STORMS

AT least thirteen Arctic explorations are planned for the coming summer, and some of them may locate the cradle of the storms that sweep the north Atlantic Ocean, Dr. William Herbert Hobbs, professor of geology and director of the geological laboratory at the University of Michigan, said in a radio talk from station WCAP.

"If certain studies in Greenland, for instance, are successfully carried through," said Professor Hobbs, "they will be of great practical as well as scientific importance, for what I have in mind is nothing less than the careful observation of the origin of the storms of the North Atlantic and Europe in the cradle where they begin their existence, and in the same early stage of their career the icebergs which are such a peril to the navigation of Atlantic waters.

"Northern storms and northern icebergs, the great perils in the navigation of the north Atlantic, alike have their breeding ground in the great flattened dome of ice which like a gigantic white cap covers almost the entire continent of Greenland—an area 1,200 miles in length with an average breadth nearly one half as great.

"The coldest place on the globe is not, as popularly supposed, the North Pole. The winter temperature at the North Pole is certainly quite warm if compared to parts of Siberia. In fact, throughout the long winter season at points along the coasts of these barren land areas the winds which blow from the direction of the North Pole are the warm ones, while those from the south are correspondingly cold.

"The coldest place where temperatures have been measured throughout the year is located in Siberia, but it is certain that in the heart of Greenland and of the Antarctic the winter cold is much more intense, for even in the midst of summer the mid-Greenland air temperatures have been found to be more than 30 degrees below zero. It is, therefore, of prime importance to find out more about the air conditions over Greenland. One of the several polar expeditions which are being organized this year, that of the University of Michigan, has been planned to study carefully the meteorological conditions of this very critical and significant area by establishing and maintaining for a year a number of weather observing points to be served by aeroplane transportation."

Professor Hobbs maintains that it is this intense cold of the interior area of Greenland which is responsible for the havoc-making storms that issue from its margin.

"The intensely cold ice-caps of Greenland and the Antarctic," he continued, "are the refrigerators of the earth above which the high currents of air which have traveled from the equator are sucked down and drained off as though through a gigantic shaft, and from the bottom of this shaft they are poured out in all directions toward the margins of the ice-cap to make their return to the furnace on the equator, thus making of our air circulation a complete circuit."

THE MINERAL RESOURCES OF THE WORLD

THAT a commercial League of Nations may possibly be established to help settle the world's problems with regard to mineral resources is foreseen by Dr. Charles K. Leith, of the University of Wisconsin, who has reached London on his way to attend an international meeting of geologists in Madrid.

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Dr. Leith points out that a mighty conflict is going on between two powerful forces: world demand for the needed supply of minerals, and, on the other hand, nationalistic forces which are working to use the mineral resources of a political state for national gain or protection.

Mineral resources are very unequally distributed among the countries of the world, Dr. Leith states, and in many cases the great centers of supply constitute essentially national monopolies. The dependence of modern civilization upon these unequally divided minerals is growing and the problem of mineral resources figures largely in the consciousness of nations.

"The satisfaction of world demand for minerals must, therefore, over-ride political boundaries," said Dr. Leith. "There seems to be no way to eliminate either set of forces. The problem is to effect a balance or adjustment between them.

"Internationalization of resources, in the sense of turning them over to some super-national control, is probably a political impossibility, even if it were desirable, which is doubtful. But there is an opportunity to standardize by international agreement the many international commercial arrangements which are now effecting a fair and workable compromise between world demand, on the one hand, and nationalistic policies, on the other."

Dr. Leith advocates an international economic conference, with fact-finding committees, and "ultimately, perhaps, what will amount to a commercial League of Nations." This, he said, would not put an end to national mineral monopolies, nor would it cause a nation rich in minerals to lose advantages of these possessions.

THE PRIMATE LABORATORY OF YALE UNIVERSITY

Of all the man-like apes, which have been studied by psychologists, the gorilla probably is the leader intellectually. This is indicated by a series of tests recently completed on a young female gorilla by Dr. Robert M. Yerkes, professor of psychology at Yale University.

Dr. Yerkes has returned from Jacksonville, Fla., where he spent six weeks testing the animal, which belongs to Benjamin Burbridge. Mr. Burbridge, an experienced hunter, captured the gorilla single-handed in the forests of the Belgian Congo. On his last trip to Africa he caught four, but two died in Africa; one, which was taken to Belgium, has since died, and the other is Congo, the one that was studied by Dr. Yerkes. Probably it is the only example of its species, the mountain gorilla, that has ever been brought to the United States.

The chimpanzee, the most familiar anthropoid ape, has been the subject of many psychological inquiries. The Yale Institute of Psychology has several chimpanzees in its "Primate Laboratory," on which tests are being conducted, but on account of the scarcity of specimens, the gorilla has never before been studied experimentally.

"One's first impression is that the chimpanzee is the more intelligent," said Dr. Yerkes, "but that is probably due to the temperamental differences of the two animals. The chimpanzee is the more emotional and impulsive; the gorilla is the more deliberate, and works calmly and with better judgment, and I should expect that the gorilla would go farther in the long run. I was able to work with Congo for hours at a time, and she stuck to her tasks. A chimpanzee by comparison tires quickly."

The animal weighs about 65 pounds, Dr. Yerkes stated, and is perhaps five years old. Although their average span of life is not certainly known, they probably attain the age of 30 or 40 years. Congo displays great strength, for "when she tugged at me, I felt as if something would break," he said. When tested with a spring balance, she pulled 160 pounds, which, considering relative weight, would be equivalent to a pull of 400 pounds by a man. Despite this, however, the animal is quite gentle, in Dr. Yerkes's opinion, for, he said, "she doesn't realize her strength."

The methods used with the gorilla were similar to those employed on the other anthropoids. One consisted in arranging the animal's food so that it was necessary to pull on a rope to obtain it, and then, after this had been learned without aid, the rope was hooked at one end, and it was necessary for the monkey to unhook it before it could retrieve the reward.

Several hundred feet of motion pictures were made of the ape while she was solving problems, and these, in conjunction with many thousand feet which Mr. Burbridge made of the gorillas in their native haunts in Africa, will throw considerable light on gorilla psychology. "You may know much about the psychology of the chimpanzee, but it doesn't help you more than does human psychology to understand the gorilla," said Dr. Yerkes. "What impressed me most is the great array of mental differences between the gorilla and the other great apes."

PSYCHOLOGICAL TESTS FOR TAXICAB DRIVERS

A new and promising set of drivers' tests, which reproduce traffic conditions of city streets by means of apparatus in a laboratory, has been devised, and is being used by taxicab companies in seven cities as a means of selecting drivers.

The tests, which are the work of Dr. A. J. Snow, of Northwestern University, are not finally perfected, but a preliminary report of them appears in a forthcoming issue of *The Journal of Applied Psychology*, because, the author says, "of the popular and misleading publicity that has appeared in newspapers and magazines" and because of the insistent demand of the automobile industry to know the facts about them.

The tests are said to be equally suited to selection of pilots for any transportation vehicle—street car, electric elevated line, steam or electric railway, and passenger or freight motor car. They are being used by different taxicab companies in Chicago, Cleveland, Pittsburgh, South Bend, Toledo, Omaha and Louisville.

The method of picking drivers is illustrated by Dr. Snow's test of "perception of space and motion." Two toy automobiles, whose motion is controlled by a system

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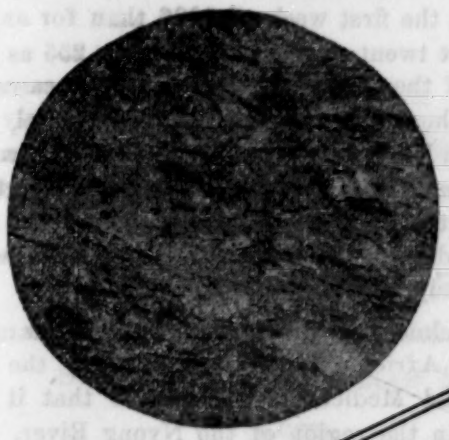

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of pulleys and weights, are mounted on a board 20 feet long. A fixed scale of numbers is marked three inches apart along tracks on the board. The prospective taxi pilot stands facing the apparatus, 15 feet away. The vehicles are moved at different speeds in various directions, according to eight different prearranged combinations. The driver is asked at a given signal to indicate at what point the two cars will pass or overtake one another. The experimenter records the error between the driver's estimate and the actual point of passing, and also the rapidity of his responses, his speed of learning and constancy of attention.

"The theory underlying this test," Dr. Snow explains, "is that the subject who is unable, with any degree of accuracy or promptness, to make the necessary judgment suffers from a visual defect, which makes him an undesirable candidate for a pilot of any transportation vehicle. It should be understood, of course, that for each test a learning period has been established. In this period the instructions are explained until the applicant can demonstrate to us an understanding of them."

Another test measures the emotional stability of a driver during an emergency by requiring him to throw certain switches at certain signals, at the same time that he receives a slight electric shock.

Recklessness is tested by having him guide a small metal pencil through miniature traffic lanes on a board. The lanes vary in width and length and have sharp turns and curves. Electrical apparatus attached to the board shows the driver's steadiness and judgment at difficult points and also registers the time in fractions of a second that it takes him to move the stylus through the points of difficulty.

An individual's intelligence is no gauge of his success as a driver, Dr. Snow finds, except that very low intelligence is a sure indication of unfitness. Consequently, drivers are given only a simple intelligence test, to test such powers as memory, attention during distractions and common sense reason. The taxicab applicants are also put through a rigorous physical examination.

A Chicago taxi company which employs 6,000 drivers has rejected 15 per cent. of its applicants since January first, using the new tests as a standard of fitness. The company reports that the reduction of accidents has been substantial.

ITEMS

A SUCCESSFUL operation of transplanting a portion of the pancreas into the mammary gland of a dog has recently been performed by Drs. A. C. Ivy and J. I. Ferrell, of the Northwestern University School of Medicine. The pancreatic gland produces potent fluids necessary to the body, including insulin, which prevents diabetes. The scientists do not believe, however, that this method of transplanting a portion of the pancreas can be used practically for the surgical cure of diabetes in man. It is merely another step, they say, to a better understanding of the physiology of the pancreas. The investigators discovered that when the animal was fed, the transplant secreted normal pancreatic juice, which is the most important of the digestive juices. This observation proves that when one eats a meal a substance passes into the blood stream and stimulates the pancreas to secrete. This agent is called "secretin," and is a hormone that is formed by a glandular layer in the intestinal wall when food and gastric juice come in contact with it. The substances that excite the formation of this hormone are, in order of their effectiveness: gastric juice and digestive products of fat. It was also found that the transplanted piece of pancreas functioned to such an extent in producing a sufficient amount of insulin that diabetes would not occur when the remainder of the pancreas was removed.

MEASLES are wide-spread and on the increase throughout the temperate zone, according to information collected by the health section of the League of Nations. From the same source it is learned that England had more smallpox cases the first week of 1926 than for any other week in the last twenty years. There were 255 as against 203 and 178 of the preceding week. All the cases are of a mild form, however, and are confined entirely to the north, mostly in Northumberland and Durham. General reports on influenza and incident respiratory infections in European countries indicate that a maximum was reached around the middle of December and that there has been a slow but steady decline ever since.

SLEEPING sickness is prevalent in the Camaroon district of West Africa. Reports received by the Society of Tropical and Medical Hygiene state that it is particularly bad in the region of the Nyong River. Over a third of the population, as nearly as can be estimated, have been afflicted, with an ensuing mortality of over ten per cent. The country has been divided into districts the better to combat the disease. In the past, say the medical workers in this area, it has been possible to save only those suffering from the first stages when the parasites are only in the blood and lymph, but it is now hoped that those whose brain tissue has been affected can be cured. The society believes that if proper means are employed to give treatment to the natives and to insure hygienic preventive measures it will be possible to eliminate sleeping sickness from this locality. Accordingly it has recommended to the Ministry of Colonies that arrangements be undertaken whereby such measures can be got under way.

Two Chicago doctors, Dr. E. R. Le Conte, of the Rush Medical College, and Dr. H. A. Singer, of Cook County Hospital, in the forthcoming issue of *Archives of Pathology* give an account of several cases of unexpected death in alcoholics that from their symptoms were not attributable to delirium tremens or alcoholic poisoning. Postmortem investigation of such cases always shows a huge fatty enlargement of the liver. The connection of alcohol with fat changes in the liver has long been recognized and in these aggravated cases it would seem that if the accumulation of fat were so great as to destroy completely the normal functions of the liver that have to do with supplying the body with sugar. Chemical examination of the blood of such patients has showed consistently a significantly low sugar content. This extensive replacement and enlargement of the liver by fat in heavy drinkers may bring about an entirely unexpected death

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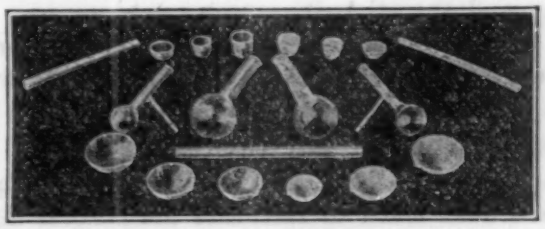

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SCIENCE NEWS

Science Service, Washington, D. C.

E. W. SCRIPPS AND SCIENCE SERVICE

INTENSE humanism, enormous avidity for knowledge, and faith in the truths of science characterized E. W. Scripps, in the opinion of Dr. William E. Ritter, his life-long friend and president of Science Service, the institution for the popularization of science through newspapers founded by Mr. Scripps. Dr. Ritter in a statement said:

After the world war, Mr. Scripps was greatly impressed with the idea that since the world was more than ever committed to democracy, democracy must become more intelligent than it ever has been.

How, he reasoned, is it possible to conceive a public intelligent enough to live healthily, efficiently, sanely, and happily in the modern world without much acquaintance with the facts and principles of the physical and humanist sciences?

Furthermore, he continued to query, since the newspaper is the greatest single agency for informing the public of what goes on in the world from day to day, and for molding public opinion on many subjects, what is more natural and more important than that this agency should supplement whatever can be done by other agencies, as the schools and colleges, in disseminating scientific knowledge among the people generally?

Another potent belief held by Mr. Scripps was that the mental capacity and emotional soundness of the average man are sufficient to make him capable of understanding and appreciating the basic truth of science if presented in simple, familiar language.

The almost necessary consequence of these ideas in the mind of so dynamically and financially competent a man as Mr. Scripps was some foundation like Science Service, if only scientific men themselves would do their share in creating and operating it.

The trustees of Science Service, the newspapers served by it and the record of the institution for its five years of life are sufficient testimony of the response of both American newspapers and American science.

In a telegram of condolence President Coolidge said: "He had done much to facilitate the general dissemination of news through his active interest in press associations, and his services in furthering the distribution of scientific and other news of a constructive character were most valuable."

THE DEPTH OF THE POLAR SEA

THE biggest geographical task awaiting voyagers to sail to the top of the world is to chart the depth of the Polar sea in all directions and to establish roughly the boundaries of the continental shelf. This is the opinion of Fridtjof Nansen, Norwegian scientist and Arctic explorer, who outlines the remaining problems of the Polar region, in the forthcoming April issue of the *Forum*.

The northernmost coast lines of the great continents, as they circle about the polar regions, have been surveyed. There may be islands, large or small, still waiting to be discovered in the Polar seas, but there is no likelihood that a great continuous mass of land has been overlooked by explorers.

What has not been done is to map the northern fringes of the continents which are covered by comparatively shallow water. This under-sea land, known as the continental shelf, often extends far out beyond the visible coast and is a part of the continent itself. The edge of a continental shelf forms a cliff where the sea floor drops to the great ocean depths of several thousand feet.

"From the north of Siberia this continental shelf extends very far, for hundreds of miles," says Dr. Nansen. "Its surface, which is remarkably even, is not very far below sea-level, much of it being less than 150 feet down.

"It was over this remarkably shallow continental shelf that both the *Jeanette* (1879–81) and the *Maud* (1922–24) drifted along their two years' drift routes. Only at one place, namely, north of the New Siberian Island, on *The Fram's* drift route in 1893, has the edge of this shelf been definitely located. At that place it was more than 300 miles north of the Siberian coast. At another point, about midway between the New Siberia Island and Cape Cheljuskin, the Russian expedition of 1913 took a sounding of 1,319 feet without reaching bottom, and it seems probable that they were then at the edge of the shelf.

"North of Canada the continental shelf also extends for a great distance, but exactly how far is entirely unknown. North of Alaska, at Point Barrow and eastward, the edge of the shelf comes very near the coast."

The Norwegian expedition of 1893–6, aboard *The Fram*, discovered that there is a deep ocean basin, with depths ranging from 9,800 to 12,630 feet, in the regions near the North Pole. But how far the deep Polar sea extends and where it is broken by submarine ridges has not yet been investigated.

The importance of also studying the physical conditions of the Arctic wastes is emphasized by Dr. Nansen, who declares that "trying to discover the laws governing the circulation of our atmosphere without a knowledge of the polar regions and their physical conditions is comparable to the action of a man attempting to study the laws by which water circulates in the heating apparatus in a house, without knowing anything about the radiators that emit the heat."

READING AND EYE MOVEMENTS

CHINESE, oldest of languages, is commonly thought of as the most difficult. But this is an error, if the difficulty of a language is measured by the speed with which it may be read.

Professor Walter R. Miles, of the department of experimental psychology of Leland Stanford University, and Eugene Shan, a graduate student, in a series of comprehensive tests have learned that Chinese may be read more rapidly than English, and that type set vertically

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is more efficient and causes less eye strain than type set as is this.

In arriving at these conclusions Dr. Miles made use of eleven Chinese students, all of whom were born in China and were brought up on "vertical newspapers"; that is, on Chinese print reading up and down. He photographed their eyes, measuring their movements and noting how long each rested on a single group of words and calculating from that their speed in reading the two classes of selections.

While the entire eye was illuminated and photographed, it was the cornea, or white of the eye, that presented the opportunity for study. The cornea, being illuminated, changed its angle of reflection during each movement. It was found that the eye is never absolutely still, for when photographing a member fixed on a single spot, its edges left a hazy outline on the negative.

The selections read were in both English and Chinese, taken from a magazine article. The Chinese was set both horizontally and vertically for various experiments. It was found that at each reading pause the eye perceived a greater number of words of vertical type than of horizontal, while a greater number of vertical words were read each second than were horizontal words.

The vertical reading matter, which Dr. Miles found to be more efficient, if applied to newspaper and magazine columns in the United States would bring about this change: You would commence reading at the upper right-hand corner of the column or page and read down, progressing by columns from right to left. Each succeeding letter of a word would be set beneath its predecessor rather than alongside. Punctuation marks to indicate pauses, sentences and paragraphs would be used as at present.

It has been a popular idea of long standing that horizontal reading matter may be perceived and understood with less strain to the eye, and, in fact, many Chinese papers have changed over to this style of type-setting during the last few years. But Dr. Miles's analysis of his investigations indicate this to be an erroneous impression. Investigations subsequent to those he has already reported upon bear out the earlier conclusions.

PORPHYRIN

A DISEASE that turns the teeth purple and makes sunlight on the skin unbearable was discussed recently by Professor J. Barcroft, the well-known English physiologist, in a lecture before the Royal Institution. The affliction is so rare that there are only three known cases in England at the present time, but it is of especial interest to physiological and medical science because the purple substance, porphyrin, is closely allied to the red material, hemoglobin, that gives blood its color. Subtracting its iron and albumin from hemoglobin by appropriate chemical means leaves porphyrin.

No one knows yet why the bodies of these unfortunate patients should be manufacturing the wrong pigment, Professor Barcroft said, but the fact remains that it is constantly being formed and deposited in their bones, teeth and skin. Porphyrin reacts strongly to the "invisible light," or ultra-violet part of the solar spectrum, so that the victims of this mysterious ailment have to wear gloves constantly, and if they go out of doors in the day time must put on heavy veils.

The only creature that normally wears porphyrin as part of its body-covering is a tropical bird, the touraco, parts of whose feathers are stained a brilliant red with a porphyrin-copper compound known as turacin. This pigment is further remarkable because it seems to be the only normal occurrence of copper as a coloring compound in feathers or skin. Turacin is soluble in weak alkali, so that when it rains and the bird comes into contact with such alkaline solutions as occur frequently in nature, the poor touraco bleaches out.

Although porphyrin is rare as a normal coloring in adult animals, it is the commonest pigment found in eggshells of birds. Almost all the colors of birds' eggs, from the blue of the robin's to the homely brown of the hen's, contain this strange coloring matter.

ELEMENT 61

PROFESSOR B. S. HOPKINS, of the University of Illinois, has isolated the hitherto unknown element 61 after detailed chemical work extending over several years.

Four hundred pounds of monazite residues, donated by one of the big manufacturers of gas mantles, yielded the new element only after this quantity of rare earth material had been subjected to repeated fractional crystallization. Professor Hopkins found it extremely difficult to separate the new element, illinium, from neodynium, another element, which masked its presence.

From theoretical considerations, physicists and chemists have predicted just what spectral flags, as it were, the new element should fly when it is detected with spectroscope and X-ray. And Professor Hopkins based his claim of discovery on many new lines in the spectrum, prominent bands in the absorption spectrum in the expected position and lines in the X-ray spectrum in the predicted position.

The element is named after the university at which it was discovered and its symbol will be the first two letters of its name, Il.

Little practical use for illinium can be predicted as it is just another of a large family of very closely related and much mixed up rare earths. Some of these rare earth elements make up the incandescent part of gas mantles in every-day use, and it is probable that small amounts of illinium are actually contained in such mantles.

Now all but two of the 92 fundamental materials of the universe, the chemical elements, have been discovered. The two still missing are numbered 85 and 87. Efforts to find element number 87, called prenatally ekacaesium, were made at Harvard by Professor T. W. Richards and Dr. E. H. Archibald in 1902 and again by Professor G. P. Baxter in 1915. All these experimenters made successive fractionations of caesium nitrate and other caesium salts. Element 87 is known to belong in the alkaline group along with sodium, potassium and caesium. Later attempts were made by Professor L. M. Dennis

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H. J. Gerstenberger, Lakeside Hospital, Cleveland, Ohio, reported a series of cases of *Herpetic Stomatitis* and *Herpes Labialis,* cured with addition of Yeast Vitamine-Harris Tablets to the regular diet.

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and Dr. R. W. G. Wyckoff at Cornell University in 1919 fractionating caesium alum and caesium perchlorate obtained from the mineral pollucite. In all cases spectrum analysis of the final products of fractionation failed to yield any lines that could not be attributed to elements already known. These final products were also examined for signs of radioactivity with negative results. Likewise in further studies of radioactive decomposition no evidence has been found for an element having the properties of an alkaline metal.

No work reported has been done in an attempt to isolate element 85 which, when discovered, will be in the same group with iodine.

The most recently discovered chemical elements are:

Number	Name	Discoverer	Country	Year
72	Hafnium	Coster and Hevesy	Denmark	1923
43	Masurium	Noddack	Germany	1925
75	Rhenium Bohemium	Noddack Heyrovsky and Doleysek	Czecho-Slovakia	1925
61	Illinium	Hopkins	United States	1926
87	Ekacaesium	Undiscovered		
85	Unknown halogen	Undiscovered		

There are places for 92 chemical elements in the scheme of things as now conceived by the chemists. All but 87 and 85 have been filled. But some believe that there is a possibility that there may exist elements 93, 94 and 95, heavier than uranium, which is 92. Discovery of 75 is disputed.

ITEMS

GERMS grow faster when they get their light arranged in a certain way, according to the results of the investigations of two Indian scientists, S. S. Bhatnagar and R. B. Lal, of the University of the Punjab, Lahore, who have just reported to the scientific journal *Nature*. The two experimenters took cultures of the germs of typhoid fever and cholera, and exposed one set to ordinary light, while the second set was placed under a beam of polarized light. Polarized light differs from ordinary illumination in that the fronts of the light waves are all arranged in the same direction, while in ordinary light they crisscross at all angles. The germs seemed to thrive much better on polarized than on ordinary light. Scientists have been much interested lately in the effects of polarized light on living things, since discoveries made by Dr. Elizabeth S. Semmens, of Bedford College, London, which indicate that the digestion of starch takes place more rapidly under its influence.

THE spread of leprosy in France has been called to the attention of the French Academy of Medicine. A report by Dr. Janselme shows that this terrible disease, usually associated in the public mind with far-off corners of the earth or with times gone by, is threatening modern France. In Paris alone there are at the moment nearly 200 cases of leprosy. These cases may be divided into two classes; the wealthy who can take care of themselves and present little danger of infecting the public, and the poor who do not go to a doctor and find out what is the matter with them till the disease has entered a dangerous stage. As the result of this unexpected communication, the Academy of Medicine resolved to make representations to the government. It was recommended to the government that strict surveillance should be exercised over all lepers, that they should be excluded from schools and from all professions bringing them into contact with the public, that poor lepers should be placed in hospitals or sanitariums and maintained there at public expense, and that a clean bill of health should be demanded from all immigrants or travellers coming from countries where leprosy is prevalent.

FARMERS of the fertile lands along the River Nile have been ordered by royal decree to plant no more than one third of their fields in cotton this year. As in the case of the rubber situation, restriction of the Egyptian cotton crop is expected to maintain high prices. The cotton order permits certain exemptions, but, barring these, if a property owner violates the decree his cotton plants will be uprooted and he will be penalized. It is estimated that the area planted to cotton will be reduced by about 180,000 acres. This is equal to nearly 10 per cent. of the acreage planted each year during the past two years.

WHILE the United States is making efforts to become independent of British-controlled rubber, Great Britain is trying to develop tobacco production in her colonies and thus reduce her dependence on American tobacco. Current figures show that over eighty per cent. of the British tobacco supply comes from the United States, and since popular tests favor this type of tobacco, little headway has so far been made in replacing it with colonial brands. The United States holds an outstanding position in the tobacco industry. Its acreage and production are the largest of any nation in the world, and in recent years it has furnished half the world's exports.

THE latest gold rush—to Red Lake, in northwestern Ontario—continues unabated, and while such modern aids as airplanes are planned for use in the spring, prospectors are now dependent upon the same means of transportation used by the Alaskan gold hunters many years ago, the dog team. Attempts to use snow motors have been unsuccessful, and the dogs have been substituted even though they cost from $100 to $200 each, according to information just received by the *Engineering and Mining Journal-Press*. Complete assays are not yet available, it was stated, but apparently the gold is finely disseminated in quartz and schist. The main vein has been opened for a thousand feet, but the width of the mineralized area has not yet been determined. A number of large mining companies have entered the field and a diamond drill outfit has been ordered, but the actual development so far is confined to three properties. The Howey Red Lake Syndicate controls one and a half miles along the mineralized zone.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE STUDY OF CANCER

Two facts about the fundamental nature of malignant tumor, which may bring nearer the conquest of cancer in man, have been discovered by Mrs. Margaret R. Lewis, anatomist of the Carnegie Institution, and Howard B. Andervont, Johns Hopkins graduate student, conducting joint research at the Johns Hopkins University.

First, they have found that, for one form in the chicken at least, cancer is a mass of white blood cells or corpuscles. White blood cells desert their normal function of being the soldiers of the body that repulse invading germs and poison, and, instead, run wild, multiply and gorge themselves until they form a mass of malignant tumor. Heretofore the nature and exact origin of the cancerous mass has been unknown.

Second, the investigators have discovered that cancer can be transmitted simply by injecting into the muscles of a well chicken either the blood plasma or the white blood cells of a chicken suffering from cancer. Not only is the simple inoculation by transplanted blood successful, but serial inoculations by means of blood have been continued through as many as four generations of malignant tumors. This is evidence of the infectious nature of cancer, for, while heretofore it has been demonstrated that portions of cancerous tissue when transplanted will produce cancer in another animal, it was not known that one could thus transmit the infectious virus repeatedly from animal to animal by means of either the blood plasma or the white blood cells. A statement by Dr. Lewis follows:

The cancer cell is a blood cell. To be sure, it is a greatly changed white blood cell, but nevertheless quite comparable with the white blood cell which grows in tissue cultures. This cell is not characterized so much by the fact that it ingests and digests foreign material as it does at any site of inflammation, as it is by the fact that in this particular case it becomes abnormally enlarged and multiplies greatly at the site of the tumor. The cells increase to such an extent and digest away the surrounding tissue that they invade the muscle of the chicken and are carried to other organs where they bring about the death of the host.

The cells in their over-stimulated condition produce an active agent and this agent is present in the blood stream of the tumor chicken as well as in the white blood cells themselves. For when the white blood cells are separated from the blood fluid leaving only the clear plasma, this plasma upon inoculation into the muscle of a chicken produces a cancer by setting up an irritation in the inoculated region which draws the white blood cells to this region, and these cells become stimulated to abnormal activity by the tumor-producing substance in the plasma.

It is a fact well known to all surgeons that inflammation itself results in some growth-promoting substance which effects repair of the injured tissue and in some instances results in a greater increase of tissue than was lost. Dr. Alexis Carrel showed that the white blood cells themselves contain a growth-promoting factor. In any inflammatory reaction, regardless of how it is brought about, the white blood cells accumulate in great numbers in the region injured and there take up and digest or remove the irritating factor. This can not yet be shown to be the cause of cancer, but we have shown that in the chicken at least it is the underlying factor concerned in the production of the cancer. Just what it is that causes the cells to go further and to enlarge more and multiply more until instead of repairing the injury they invade the tissue and bring about the death of the host is a matter we hope to know more about later.

Whether these results can yet be applied to higher animals or to human beings has not yet been determined. There is no question but that the human cancer is partly made up of blood cells and that it can in some instances be shown to be the result of slow inflammatory conditions. Whether the active principle is contained in the blood of human beings remains to be determined. At any rate the underlying factor concerned in all the tumors which have so far been produced by bacteria, by virus, by chemicals or by parasites is a slow inflammatory reaction with the resulting accumulation of white blood cells in the injured region.

VACCINATION FOR TUBERCULOSIS

WILL our descendants be vaccinated for tuberculosis much as we now are for smallpox? That even the most conservative in the medical world do not consider such a future development impossible is shown by the editorial attitude of the *Journal of the American Medical Association.*

Discussion of the most recent results of the tuberculosis inoculation experiments of Professor Albert Calmette, of the Pasteur Institute, contrasts his methods with those of a German experimenter in this field, Dr. H. Selter, of the medical faculty of the University of Königsberg. Attenuation of a disease germ to such a degree that it will confer immunity but will not cause serious illness has been the aim of many investigators for many diseases. Professor Calmette and his associates believe that they have attained such a weakened strain of bacilli by growing them for thirteen years in a medium consisting exclusively of bile.

Some 4,517 children have been vaccinated by Professor Calmette since June, 1924. While detailed reports on all these cases are not quite ready for publication the following editorial comment is significant: "The vaccinated children all come from an environment in which open tuberculosis close at hand made natural infection seemingly inevitable. The records of 423 infants for the first six months after vaccination have been published. Approximately one third of these children have been exposed within the family. In not one of them has a death occurred from recognized tuberculosis, although thirty have

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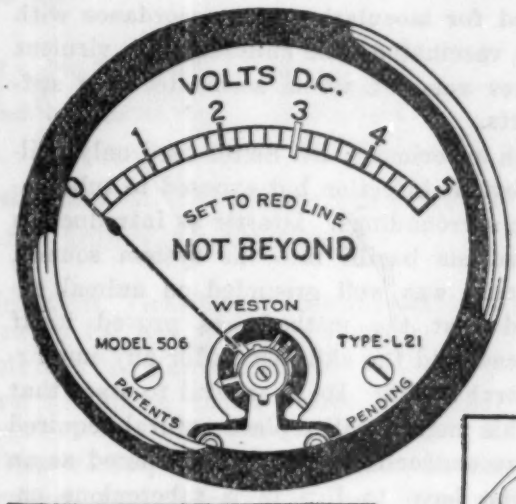

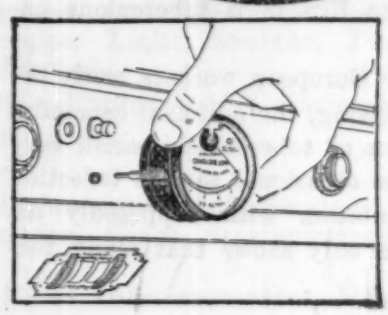

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died from other causes. Calmette and his associates have compiled figures showing a mortality of 24 per cent. in three years for non-vaccinated children of tuberculous parents living under the same conditions.''

Almost simultaneously with the last published account of Professor Calmette's results, Dr. Selter makes the announcement through a German journal, the editorial continues, that to confer real immunity virulent living bacilli should be used for inoculation. In accordance with this theory he has vaccinated nine children with virulent tuberculous cultures none of whom seems to have suffered any ill effects.

As in the French experiment, Dr. Selter used only children free from previous infection but exposed to tuberculosis in their home surroundings. Drastic as introduction of virulent tuberculosis bacilli into the system sounds, he felt that the trial was well grounded on animal experimentation and that the method has proved itself harmless. In no case did the children suffer any impairment to their general health. He is careful to state that he does not think his method will replace natural acquired immunity but he recommends that it be considered as an aid to infants who have to live in a tuberculous environment.

While the efforts of these European workers merit the close attention they are receiving, the editorial concludes with the warning that strains of tuberculosis bacilli vary greatly in strength since the occasional serious infection of animals following inoculation with supposedly attenuated strains of bacteria only shows that many factors are still unknown.

BLOOD TRANSFUSION

IMPORTANT experiments on blood transfusion, made by Professor Yourevitch and Mlle. Teleguina, of Prague, appear to lead to the conclusion that special human blood donors will no longer be required in cases where transfusion is necessary to save a patient's life. The blood of a sheep or a cow might serve the same purpose, and special preparations of solution could be made in advance, and kept in bottles until required.

It has long been known that the most important point about blood in regard to transfusion is its specificity. That is to say, a rabbit can only be saved by the injection of the blood of another rabbit. If the blood of a different animal is injected into its tissues, it dies immediately. In the case of human beings, blood has been divided into four groups. When an injection has to be made, the blood of the patient has first to be tested to see which group he belongs to. Only rare individuals of the fourth group can give blood to any of the others with beneficial and not dangerous results.

Professor Yourevitch and Mlle. Teleguina have opened up an entirely new line of treatment. They separated the red blood corpuscles from the serum by centrifuging methods. They found that the poisonous qualities which on injection have such harmful effects are in the plasma, and that if the separation or ''washing'' is thoroughly carried out, the red blood corpuscles of an animal of one species can be injected into another without the slightest danger, but, on the contrary, with completely satisfactory results.

Rabbits which had lost an absolutely fatal quantity of blood could be saved by the injection of sheep's blood which would have been highly poisonous to them, provided only the washed red corpuscles were injected. A rabbit which had received 10 to 15 cubic centimeters of unwashed ox blood died within five or six minutes. Another rabbit was given similar blood which had been partially washed, added to some of its own. After a period of serious prostration, it recovered. But a rabbit which had received only the red blood corpuscles of ox blood, which had been thoroughly washed, recovered completely without any detrimental symptoms.

It is confidently suggested by the investigators that in cases where human blood of the right group is not immediately available for transfusion, blood of any other group would be equally beneficial, provided only the washed red corpuscles were used. They also indicate that in their opinion blood of animals could probably be used in the same manner, if no human blood could be obtained.

It is further stated that a preparation of red blood corpuscles in a salt solution has been kept perfectly in bottles, and that there is no reason why such a preparation could not be made up in a standard manner and stocked for use according to necessity.

RELATIVITY

FAILURE to find any evidence for the motion of the earth through the ether which is supposed to pervade all space, and thus to confirm the recent work of Dr. Dayton C. Miller, at the Mt. Wilson Observatory in California, is announced by Dr. Rudolph Tomaschek, of the University of Heidelberg, in the *Annalen der Physik*.

Dr. Miller, who is professor of physics at the Case School of Applied Science at Cleveland, repeated the Michelson-Morley experiment on Mt. Wilson, 6,000 feet above sea level. This experiment measures the difference in the time taken by two beams of light to travel in two paths at right angles to each other. While a negligible effect was obtained when it was performed at Cleveland, the Mt. Wilson results showed what was apparently a drift through the ether, because the light beam traveling in the direction of the supposed ether drift took longer to return to the starting point than the one going at right angles to it.

Dr. Tomaschek has repeated two other experiments designed to test the ether drift, both of which use a charged condenser, somewhat similar to the condensers used in radio-receiving apparatus. In the first one he sought to observe the magnetic field which should be produced by the motion of such a condenser through the ether, but none was observed, even though it was performed at altitudes of 65 feet, 1,850 feet and 11,400 feet, the latter being on the Jungfrau, one of the highest peaks in the Alps.

The other experiment was one originally performed in England by Professor F. T. Trouton and H. R. Noble, of the University of London, in 1903. This consisted in suspending a light disc-shaped condenser, also electrically charged, by a fine wire, so that it was free to turn. If the ether is drifting by, the condenser would tend to hang at right angles to the direction of the drift, so the

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experimenters hung it with its plane in the direction of the supposed motion through the ether, and sought to observe the slight turning of the condenser.

No such turning was observed by the original experimenters, or by Dr. Tomaschek at any of the altitudes, although his apparatus was sufficiently delicate to detect a relative motion of the ether and the earth much smaller than that indicated by Dr. Miller's results. As the Einstein theory of relativity was based partly on the fact that no such ether drift could be observed, and as Professor Miller's work has been said by some authorities to necessitate a considerable modification of the relativity theory, Dr. Tomaschek's work is taken as evidence in its favor.

RADIOACTIVE DECOMPOSITION

COMMON brass is radioactive matter, according to Dr. Robert A. Millikan, director of the Norman Bridge Laboratory of Physics of the California Institute of Technology, in a statement following recent scientific experiments conducted in brass apparatus placed several fathoms deep in alpine lake waters. This conclusion comes as a by-product of the epochal discoveries of the activities of high-frequency cosmic rays. Incidentally, Dr. Millikan suspects that all matter is capable of spontaneous breakdown, or radioactive decomposition, though evidence in most cases is naturally lacking.

By immersing electroscopes shielded by brass and zinc containers, far down in the icy waters of Muir Lake in the high Sierras, Dr. Millikan was able to shut out even the highly penetrant cosmic rays then under observation. In spite of the reasonable assurance that the lake water, which is merely pure melted snow, contained no radium, it was found that the electroscopes were slowly discharged, showing that both the copper and the zinc in the instruments were slowly disintegrating at a rate fast enough to emit electromagnetic energy in the form needed to affect the electroscope.

Radioactivity—or the transformation of matter into a new species of matter plus new energy—has been considered a special prerogative of a few freak elements, notably radium, uranium and thorium. It now appears probable that the whole gamut of elements carries such possibilities within one grand system of evolution of matter.

THE COLOR OF FLOWERS

IT makes no difference whether a flower is red or blue, its hue is due to the same fundamental substance. Its redness or blueness depends on the chemical nature of the plant sap. For example, deep red dahlias and blue cornflowers contain the same pigment, but the sap of the dahlias is acid and that of the cornflowers is alkaline; and this makes all the difference. Intermediate shades depend on the degrees of acidity or alkalinity.

The name of this versatile plant pigment or dye is "anthocyanin," according to Professor R. Robinson, well-known English physiological chemist, who told of investigations in this branch of plant physiology before the Royal Institution of Great Britain. This strange-looking word is made up of two simple Greek roots, which translate into "flower-blue," which is exactly descriptive of one of its phases.

There are really many distinct anthocyanins, Professor Robinson explained, though chemically they are practically identical. By analysis they can all be shown to be derived from three fundamental substances, which are closely related to each other.

There appears also to be a fourth member of this group of basic flower dyestuffs, which has long been exploited by tropical Indian tribes as material for rouge, which, however, is used among them by men only.

"The Indians of South America in the vicinity of the Orinoco prepare a red plant pigment called 'carajura' or 'chica.' It is so valuable a commodity that it is said of a poorer native, 'he can only paint half his face.' The chemical examination of carajura by Professor A. G. Perkin has resulted in the isolation of a red crystalline constituent called carajurin. The molecules of the salts of carajurin with acids have been proved to contain the characteristic nucleus of the anthocyanidins and apparently carajura proclaims a fourth anthocyanidin. It is unique both as a cosmetic and as an object of scientific research."

ITEMS

A SECRET process that allows the metallurgist to detect marks on steel that a theief or wrongdoer thinks he has entirely obliterated has been developed here as a result of research by metallurgists of the U. S. Bureau of Standards. The method originated when the experts were asked to study an army pistol with identification number badly mutilated. Through their efforts the weapon was turned into a valuable piece of criminal evidence. The method used has since been employed extensively by police officials. Details of the process will not be revealed for reasons of public safety, but it is explained that it rests upon the fact that metals, generally regarded as dead and inert, are actually alive in the sense that they retain in their internal structure evidence of their past history and experience.

DIABETES can be cured by a new treatment, according to an Austrian physician, Dr. Gustav Singer, who recently reported the results of his researches before the Vienna Association of Physicians, after several years of investigation on animals followed by a number of clinical cases. The new method consists simply in the injection of certain proteins into either the body tissues or the blood stream. The effect is more lasting than that of insulin, having persisted for six months or more in more than twenty cases. Dr. Singer states that in the clinical cases thus far treated 55 per cent. of the patients have shown substantial improvement and are able to go about their daily occupations without inconvenience while they are undergoing treatment.

THE fossil of a fish which lived about 400 million years ago and had wing-like scales, as its generic Greek name Pterolepis indicates, is one of three fossils presented to the Princeton Geological Museum by Dr. Johann Kiaer, of the University of Oslo in Norway. These fossils, which arrived here this week, are, to the ordinary observer, only faint impressions about an inch and a half long in bits of rock about three inches square, but to the scientist they mean that 400 million years ago there were fish having external skeletons which served as armor to protect the head and body.

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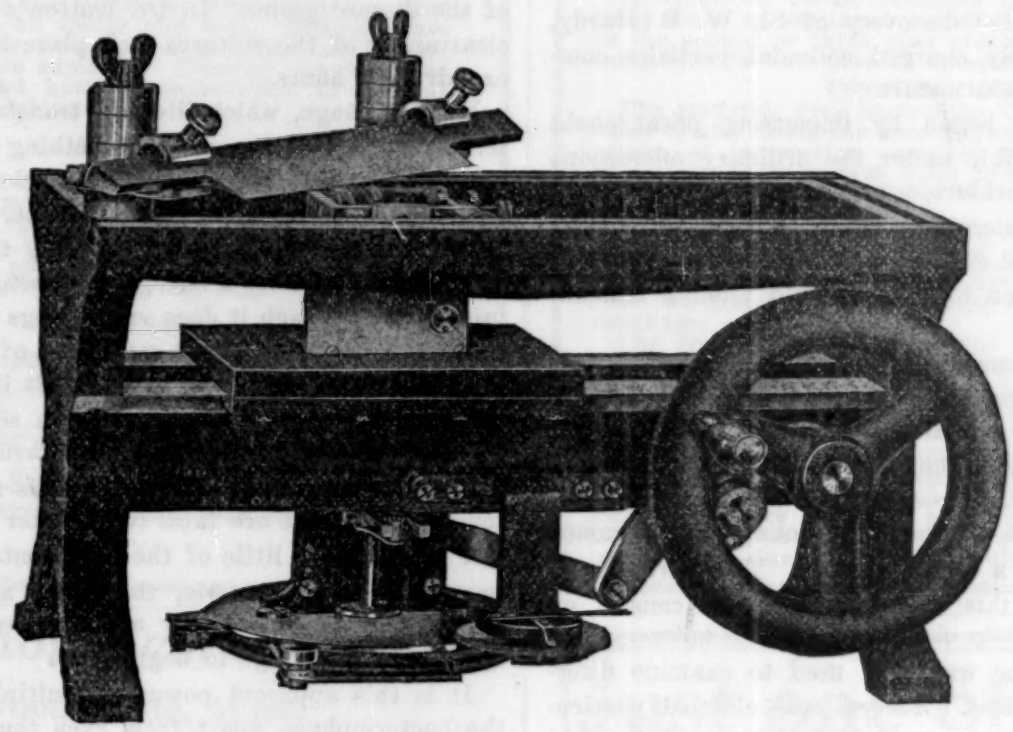

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SCIENCE NEWS

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THE DETECTION OF NON-FILTERABLE MICROORGANISMS

A NEW and original method, by which ultra-microscopic particles a thousand times smaller than those observed with the aid of ultra-violet light may be rendered visible, is described by Professor H. Bechold, of the Institut fuer Kolloidforschung at Frankfort-on-Main, who is well known in scientific circles as a colloid chemist. The method is based on the discovery of Sir W. B. Hardy, F.R.S., that negatively charged colloidal particles combine firmly with certain metals.

Professor Bechold began by immersing paratyphoid and other bacilli visible under the ordinary microscope in a solution of gold chloride, and subsequently reducing them to ash on a microscope slide, so that only their gilded shells remained. These could then be used as centers for the deposition of further gold from a suitable solution.

The method was next applied to solutions of egg albumen, the particles of which are much too small to be visible even under the ultra-microscope. Nothing was revealed on ashing, but when the invisible gold particles were used as nuclei for the deposition of further gold, it was possible to count accurately the number of albumen particles present in a given volume. The particles of albumen counted in this way were found to consist, on the average, of only fifty chemical molecules apiece.

The same technique was then used to examine filter-passing micro-organisms. Success was claimed particularly in the case of the bacteriophage discovered some six years ago by the famous French-Canadian bacteriologist, d'Herelle. This bacteriophage is one of the great mysteries of micro-biology. It brings about the destruction of dysentery and other bacilli, but expert opinion is sharply divided as to whether it is a living organism or a ferment. At any rate it is enormously smaller than the bacteria which it attacks.

Professor Bechold has also attempted to gild the ultra-microscopic virus of smallpox, but so far without success, although he is continuing his experiments. In view of the claim by Dr. W. E. Gye and J. E. Barnard that cancer is due to a filter-passing micro-organism, great interest has been excited by Professor Bechold's investigations among British cancer research workers.

BACTERIOPHAGE

BACTERIOPHAGE, that mysterious principle or organism, as yet unseen by any scientist though used daily by many, has been discovered in a new rôle as devourer of the deadliest of bacteria, by Dr. Paul F. Clark and Alice Shiedt Clark, of the University of Wisconsin, and Dr. L. O. Dutton, of the Methodist Hospital, Memphis, Tenn.

The most dangerous of the disease-causing organisms which the three researchers have discovered to be a part of the bill of fare of the bacteriophage is known as the hemolytic streptococcus, or blood-dissolving chain-germ, because of its fatal action in the blood, causing one of the worst types of blood poisoning. It is also the causal organism of scarlet fever, and of one of the deadliest types of pneumonia.

Cultures of this organism in test tubes grow vigorously and make the nutrient fluid cloudy, but the introduction of a little material containing the bacteriophage soon makes it clear again, due to the death and disintegration of the disease germs. In Dr. Dutton's experiments, this clearing-up of the cultures took place in as short a time as thirty-six hours.

Bacteriophage, which literally translated means "bacterium eater," is a puzzling something discovered by the researches of F. W. Twort, a British scientist, and F. d'Herelle, a French Canadian. Bacteriologists are very much at odds over it, some claiming that it is a living organism, or at least a living substance, and others maintaining that though it does some things that living beings do it does not have all the attributes of life.

If it has an organized body at all it must be exceedingly minute, for it has never been seen even with the ultra-microscope, and it can pass through the pores of a fine porcelain filter. Moreover, it is not killed by high temperatures that are fatal to all other known organisms. Yet when even a little of the fluid containing it is added to a culture of bacteria, the latter are soon dead, no matter how numerous they are nor how little there was of the bacteriophage to begin with.

It is this apparent power to multiply itself that sets the bacteriophage apart from even the most complex of lifeless chemicals, for lifeless things do not have the power of self-propagation. Much research on this puzzling stuff is now in progress, from which far-reaching effects in medicine and sanitation may result.

THE FUNCTION OF THE PITUITARY GLAND

THE gorilla is, from the point of view of the structure of his anatomy, man's nearest relative. Contrasting man and his ape cousin in a lecture recently given before the Royal College of Surgeons, Sir Arthur Keith, M.D., F.R.S., said that man has stayed in a state of physical development corresponding to a gorilla's youth. In his evolutionary career man has moved in the direction of brain, but his next anthropoid neighbor has progressed in the direction of brawn.

About forty or fifty years ago when cases of abnormal growth were beginning to be studied, some observers were struck with the fact that patients suffering from a malady now known in medical parlance as acromegaly underwent changes similar to those occurring in the maturing phases of a gorilla. There was an immediate inclination to explain such phenomena as an evolutionary reversion to an ancestral state now represented in the bodies of gorillas.

Sir Arthur says of this explanation:

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"It seems more legitimate, in the present state of our knowledge of the action of hormones on the growth of the body, to regard gorillian characters, whether they occur as a normal manifestation in the life-history of the gorilla or as an abnormal manifestation in the life-history of the acromegalic, as being due to an increased action of that element of the pituitary gland which influences the processes of growth."

This argument has been opposed on the ground that the gorilla does not possess an unusually large pituitary gland, but this contention is refuted by calling attention to the obvious complexity of that body which produces many substances the influence of which can not be determined "by the crude use of scales or microscope."

Careful study of abnormal growth cases show the influence of the pituitary gland on the growth of the muscular, bony and alimentary systems, just the systems which undergo so great a degree of increase during the later stages of the development of the gorilla.

"We may therefore legitimately infer," concludes Sir Arthur, "that, in the evolution of the gorilla, the pituitary has played a prepotent part. The evidence, as it stands, is enough to justify the student of man and ape in believing that he has obtained a real glimpse into the machinery of evolution."

THE WHITE INDIANS OF DARIEN

A RACE within a race. In the White Indians of Darien, famous as a part of San Blas tribes that are resisting Panamanian oppression and rule, there lies the potentialities of a new white race.

Such is the conclusion of Dr. Reginald G. Harris, director of the Biological Laboratory of Cold Spring Harbor, Long Island, N. Y., who last year, with the assistance of Mrs. Harris and R. O. Marsh, the civil engineer and explorer who brought the White Indians to America, made a first-hand genetical study of the San Blas in their native villages, hitherto closed to foreigners, white or black.

How he made a careful analysis of the family histories of the White Indians is told in a scientific report to appear in the next issue of the *American Journal of Physical Anthropology* of which Dr. Aleš Hrdlička, anthropologist of the Smithsonian Institution, is the editor.

"That the condition 'White Indian' is genetical in nature is amply demonstrated by the data contained in the family histories," Dr. Harris will say in the report. "The White Indians thus hold potentialities for race production."

The San Blas Indians, both brown and white, are uncontaminated by Caucasian blood since their customs and race prejudices have assured exceptional "purity." Mr. Marsh's party, of which Dr. Harris was a member, was the first white group that had ever been allowed to stay in one of the San Blas villages overnight. Moreover, the White Indians, as well as the brown from which they came, are clearly Indians, not hybrids, and Dr. Hrdlička in another article in the same journal reports that the San Blas are related to and apparently the same as the famous Mayas of Central America and Mexico who years before the time of Christ had a civilization whose ruins to-day puzzle and astonish archeologists.

In the technical sense the White Indians are partial albinos, but Dr. Harris will say: "Their appearance is obviously the expression of a homozygous recessive condition, due originally to a mutation in one or more genes."

This means that sometime in the past something happened within the germ cells of the brown San Blas Indians that caused the white characteristics of the White Indians to appear. The brown pigmentation usually gains ascendancy over the white or partial albino characteristics in the offspring, but occasionally the white becomes dominant and a brown Indian couple will have a white child.

According to legend the San Blas have hated the white race since the days of the Spanish conquest, and therefore the White Indians have been looked down upon by the browns. Although they were not banished to the hills and did not form separate colonies as previous reports brought by Mr. Marsh indicated, infants that proved to be white upon birth were often killed and even now white Indian men are forbidden marriage altogether. White women are allowed to marry, but for one reason or another, no doubt mainly because the brown women are far more attractive than the white, this is very rare.

HIGHWAY RESEARCH

POOR roads may save road taxes but the tolls they take on tires and in gasoline consumption make the motorist pay heavy taxes in increased fuel consumption and rubber bills, according to Professor S. S. Steinberg, of the University of Maryland, assistant director of the National Research Council's Highway Research Board.

Concrete or brick roads save tires according to tests which have been made to determine what kind of road wears out tires the least. In these tests, both cord and balloon tires are used at the inflation recommended by the manufacturers. The car is run up and down selected level stretches of different road types until the vehicle has covered a distance of 500 miles, after which the wear of the tires is determined. Thus far it has been found that tires wear the least on concrete and brick roads, the loss in weight of each tire on these surfaces being about one ounce for a 500-mile run.

"The tire wear on gravel roads is found to be from two to seven times that on concrete or brick, while that on macadam varies from ten to fifty times the wear on concrete or brick, depending upon the condition of the surface. The results also prove that front tires wear less than rear tires, the amounts being fifty per cent. to seventy-five per cent. less," he continued. "The relatively greater wear on rear tires is due to the bounding and spring of the rear wheels when traveling over rough surfaces. Experiments also show that when we start our cars from rest the rear wheels exert a downward kick on the pavement, ranging from 100 pounds to as much as one half a ton. This blow must be resisted by the rear wheels and axle every time the vehicle is started.

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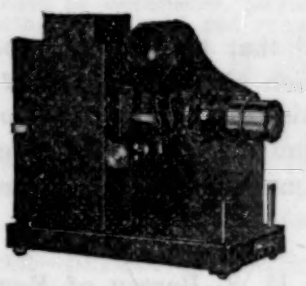

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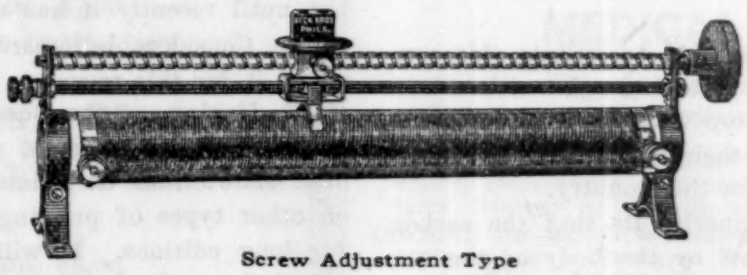

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Artificial winds created by large electric fans driving through a tunnel large enough to hold a full-sized automobile are used to study the effect of wind resistance. The velocity of these man-made winds varies from ten to forty miles an hour, thus producing the same effect as if a car were driven through still air at these speeds. By testing a number of makes of cars, it has been found that when you drive at thirty-five miles an hour, you are using about eight horsepower to overcome the wind resistance. If you reduce your speed to twenty-five miles an hour, you save five horsepower.

THE ELECTRIC INCUBATOR

An electric incubator is the most satisfactory substitute for a hen, according to Edmund Burke, chemist at the Agricultural Experiment Station at the University of Montana.

Temperature is the most important factor in hatching eggs, he has found. The temperature of an electric incubator can be more readily controlled to simulate the temperature conditions under the hen than the older types of hot air incubators. It has been found that eggs hatching under a hen vary several degrees in their temperature on the top and the bottom. Why this is desirable is not known, but the fact remains that up-to-date a responsible motherly hen hatches a higher percentage of chicks than any incubator.

English experimenters have tried to imitate this condition by covering artificially hatching eggs with a thin sheet of rubber to keep the top warmer. They claim a highly increased per cent. in their hatch, but the experiment has not been repeated in this country.

Mr. Burke found in his experiments that the carbon dioxide and moisture given off by the body of the hen during hatching are necessary elements in the chemical changes that render the calcium of the shell available for the bone formation of the embryo chick. The electric incubators were found to be superior in reproducing this condition also. The amount of moisture and carbon dioxide could be more easily controlled than in the hot-air types and the quantity of each admitted to the eggs approximated more nearly the amount given off by the hen with a consequent increase in the hatching percentage of viable chicks.

BRITISH EXPEDITION TO SEEK MAYA RUINS

Mayan ruins on British soil in Central America are the objectives of an expedition under T. A. Joyce, deputy keeper of the department of ethnography of the British Museum, London, and F. A. Mitchell-Hedges, now in the field, on a voyage of exploration in British Honduras.

The expedition is an outcome of the interest of the results obtained by Mr. Mitchell-Hedges last year, when he was accompanied by T. W. Gann, the well-known authority on Central American archeology, and spent some months in exploring the ancient cities of the Maya. One of the most remarkable monuments discovered by him was a vast amphitheater which is like nothing else known in America.

A great deal of work done was of a pioneer character, and did little more than clear away the jungle, but it was possible to conclude that the remains belonged to two periods, of which the work of the earlier was of a much higher character than that of the later. In the former were found blocks covered with painted stucco, which evidently had been introduced into the work but belonged to a much earlier period still. The buildings were probably ceremonial. At any rate they showed no sign of military defenses.

It may be expected that the present expedition will obtain much information which should be of value both in itself and in assisting to clear up some of the problems of archeology and history in the other states of Mexico and Central America.—*E. N. Fallaize.*

ITEMS

Experience at the U. S. Bureau of Engraving and Printing has shown that by the application of a thin layer, only 1/5000-inch thick, of chromium to electrolytic plates used for printing paper currency, the life of the plates is increased to over twice that of case hardened steel plates, and several times that of the nickel faced electrolytic plates prior to the application of the chromium upon them. This increased service is due to the extreme hardness of chromium, the hardest metal known. Chromium plating has long been known to be possible, but until recently it has not been commercially practicable. Considerable research was required to develop and adapt it for this purpose. This study was conducted by H. E. Haring, of the Bureau of Standards. According to Dr. William Blum, of that bureau, subsequent tests have shown that chromium plating is likewise valuable on other types of printing plates, especially those used for long editions. It will also probably be useful on dies and gages where extreme hardness is required, and may obviate case hardening them.

Thousands of specimens of rare plants from China are now being packed at the U. S. National Herbarium, for shipment to six foreign museums as well as to two of the great herbariums in the United States. The bulk of the collection was brought home over a year ago by Dr. Joseph F. Rock, noted explorer-botanist, from the almost unknown mountains of southwestern China, and has kept a corps of plant experts busy ever since, arranging and classifying the material. In all there are some 60,000 plants, representing about 12,000 species. In addition to the Rock collection there are also many plants gathered in China by a native Chinese botanist, R. C. Ching, who accompanied an expedition into Kansu province under Frederick R. Wolsin.

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If vacancies occur, students from other institutions desiring advanced standing may be admitted to the second or third year provided they fulfill the requirements and present exceptional qualifications.

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SCIENCE NEWS

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PAPERS AT THE TULSA MEETING OF THE AMERICAN CHEMICAL SOCIETY

FOR the first time in its history, the members of the American Chemical Society were told on April 6 of the discovery of a new element, one of the building blocks of the universe, by one of their fellow members. Professor B. S. Hopkins, of the University of Illinois, told of his work in collaboration with J. Allen Harris and L. F. Yntema, which recently resulted in Illinium, element No. 61 in the list of the elements, the first to be discovered in the United States. Their work leaves but two more elements to be discovered. The element was obtained from monazite, a material used in the manufacture of gas mantles, but it was necessary to repeatedly dissolve and crystallize it to get the portions in which the new element was found. Finally, by photographs made with the aid of X-rays, spectral bands were obtained which correspond to the missing element, for many of its properties were known long before its discovery. The wave lengths of the lines on the plate were within four twenty-five billionths of an inch of those calculated in advance, said Professor Hopkins, and though they were faint, their presence was verified by a number of disinterested observers. Doubtful plates were rejected.

THE idea held by many people that vitamins in vegetables are harmed by cooking was attacked by E. F. Kohman, of Washington, D. C., speaking before the annual meeting of the American Chemical Society. Vitamin C, the one which prevents scurvy, has been most commonly supposed to be injured by cooking, but vitamin A, which insures normal growth, has also been included in the list, Mr. Kohman told his hearers. The damage was supposed to result from the combination of the vitamin with oxygen from the air at the high temperatures of cooking; but in tests which he conducted Mr. Kohman was unable to confirm these suppositions. "The only experimental evidence in the literature that vitamin A is destroyed by oxidation is in connection with fats when they are directly exposed to air in shallow layers while being heated," said Mr. Kohman. "This condition is scarcely ever met with in the handling of foods. There is an abundance of evidence that vitamin A is not destroyed by oxidation in the general handling of foods. Live steam has been passed through butter fat for six hours with no loss of vitamin A. Steenbock and Boutwell heated yellow maize, chard, carrots, sweet potatoes, squash and alfalfa under pressure for three hours at 248 degrees Fahrenheit, with no loss of vitamin A being evident. This is a more severe temperature than any canned foods are ever subjected to. We have doubled the process of canned peas from twenty-five to fifty minutes at the same temperature without any loss of vitamin A being made evident under either condition. It is possible that vitamin A might be destroyed under these conditions of heating foods if oxygen were actually bubbled through them. But within the conditions of handling foods it may safely be stated that vitamin A is not oxidized."

VITAMIN D, the substance in milk that prevents rickets, a disease of the bones, is increased when the milk is exposed to ultra-violet light, invisible rays given off by the sun and some mercury vapor arc lamps. However, it is not likely that dairies will begin to use ultra-violet light on their products, for vitamin A, the substance that insures normal growth, is destroyed by the same process. Professor J. S. Hughes, of the Kansas State Agricultural College, told members of the American Chemical Society of his work in collaboration with R. W. Titus and J. B. Fitch on this subject. In their experiments one set of chicks was fed with milk that had been exposed to ultra-violet light, while a second group was fed with untreated milk. The latter developed normally, but the first group developed conditions typical of the lack of vitamin A, Professor Hughes stated.

COTTON as a fabric material is a commonplace of every one's daily life, but most people seldom think of the important part cotton, as a chemical, plays in their ordinary activities. G. J. Esselen, Jr., of Boston, pointed out the magnitude of cotton's share in American chemical industries. Nearly 190,000 bales were used during 1925, he told his hearers, in the manufacture of such diversified products as rayon or synthetic silk, celluloid, photographic films, automobile finishes and similar lacquers, artificial leather, paper and explosives such as smokeless powder and dynamite.

THE cotton plant is a veritable mineral mine, under the hands of a chemist, according to Dr. J. S. McHargue, of the Kentucky Agricultural Experiment Station. In addition to iron, phosphorus, magnesium, calcium, potassium and sodium, metallic elements commonly found in plants and considered essential parts of them, Dr. McHargue found copper, manganese and zinc. He found the copper and zinc in greatest concentration in the kernel of the cotton seed, and suggests that these elements play a vital part, as yet unknown, in the economy of the plant.

THE production of a refined and delicate perfume from ill-smelling petroleum was demonstrated to-day by Harold S. Davis, of the Arthur D. Little corporation. Recent investigations in this field indicate that the use of petroleum as a source of raw material for the synthesis of complex carbon compounds may in time transcend its importance as a fuel. Various alcohols may be made from crude mineral oils, none of which will interfere with the Volstead Act, but some of which have recently come into common use as solvents for lacquers and the like. Among these alcohols that may be made from petroleum, that known to chemists as "tertiary butanol" is of particular interest and promise for industrial use as a consequence of certain unique chemical and physical properties, such as serving as the basic material of a synthetic scent.

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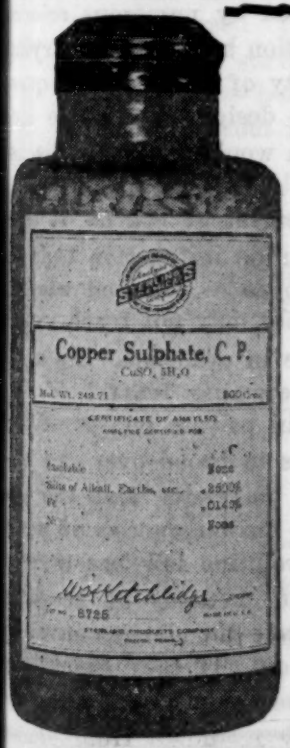

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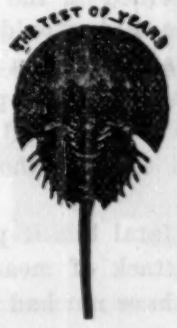

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How synthetic fuels for internal combustion engines may be made from coal and water was described by C. R. Hoover, of Connecticut Wesleyan University, and associate investigators. The material employed in the process is the familiar blue water gas, made by passing a current of steam over a bed of red hot coal. When this water-gas is conducted at high temperature and pressure over a catalyzer, such as finely divided nickel, copper, iron or other metal, the carbon in part combines with the hydrogen, giving a gaseous mixture that contains from twenty-five to thirty per cent. of compounds of higher heating value. By increasing the pressure of the process it is possible to obtain compounds containing oxygen as well as hydrogen and carbon, such as alcohols and aldehydes of various kinds, some of which may prove on further investigation to have commercial possibilities.

MEASLES PREVENTIVE AND CURE NOW ASSURED

MEASLES may become one of the preventable diseases in the very near future. The latest of medical achievements bids fair to bring this epidemic disease of childhood under partial control at least.

The discovery of a streptococcus that causes measles by Dr. N. S. Ferry and L. W. Fisher, of Detroit, has been announced by the American Medical Association. This organism produces a soluble toxin that can be used in the production of antitoxin on a large scale. This antitoxin, which consists of horse serum treated with the measles toxin, can be used in both preventive and curative treatment of measles.

The triumph of medical science over diphtheria and scarlet fever, both of which diseases are now capable of being controlled, was accomplished by similar steps and methods.

The new measles discovery is in accord with similar results obtained by Drs. G. F. and Gladys H. Dick, in Chicago, in 1924, in studies on scarlet fever. It appears, according to medical authorities, that in some of their many forms streptococci are accountable for a variety of diseases, besides being able to induce general blood poisoning.

Blood serum from convalescent measles patients has been in current use with some degree of success as a means of prevention with children that have already been exposed.

Now schools should not be closed when measles are prevalent, according to Dr. Victor C. Vaughan, chairman of the division of medical science of the National Research Council, whose son, Dr. Henry F. Vaughan, health commissioner of Detroit, has been concerned in the research on measles toxin. Every child, he said, should be inspected daily because a skilled physician is able in the majority of instances to detect this disease in the pre-eruptive stage. When this is done the child should be sent home and put to bed and exposed children should be treated with the convalescent serum.

Uncomplicated measles is not highly fatal but it predisposes to virulent pneumonia. One attack of measles gives lasting immunity while adults who have not had the disease are quite as susceptible as children. The younger the child, however, the more fatal is the disease, the death rate being highest among those under one year of age.

THE ANTI-EVOLUTION LAW IN TENNESSEE

TENNESSEE'S anti-evolution law after being in force for nearly a year has had a serious effect upon the schools of the state, according to Judge John R. Neal, member of the counsel who last summer defended John T. Scopes at the celebrated Dayton trial. The appeal of the verdict against Mr. Scopes on the grounds of the alleged unconstitutionality of the law is still pending before the Tennessee Supreme Court, and will probably be heard in May.

Judge Neal made the following statement through Science Service:

"The appalling effect of the anti-evolution law in Tennessee is written in the anxious faces of every science teacher in the high schools, and the state university. At least to these individuals it has ceased to be a joke and become a terrifying reality, for the following reasons:

"In the first place, immediately after the passage of the law, the text-book commission of the state, of which the governor is the head, either deleted the science texts books of all reference to evolution or selected new science books of an inferior character because they contained no reference to evolution. The teachers were informed that unless they made sole use of these inferior text-books they would be dismissed and prosecuted under the anti-evolution law.

"Second, I have been informed by numerous science teachers that almost every recitation has become a trying ordeal on account of the necessity of avoiding the questions either asked innocently or designedly by the students the proper answer to which would lead to a discussion of evolution.

"Thirdly, the public announcement of boards of education and superintendents of public instruction that no teachers of science will be employed or retained who do not satisfy them that they will not only not teach evolution but that they do not believe in evolution. As a result many timid teachers are becoming fearful of discussing scientific subjects even in private conversations.

"An ominous silence continues to brood over the university. The president of the university and the administrative authorities refuse to answer queries of newspapers as to whether the anti-evolution law has necessitated changes in text-books and methods of teaching science. They evidently appreciate the danger involved in frankly answering this question. If they should say yes they realize they would receive the contempt and ridicule of the scientific world; if they say no, they subject themselves to criminal prosecution. Discontent and dissatisfaction among the student body however is becoming more apparent every day. The intelligent and ambitious student who desires later to pursue professional courses in the larger Eastern and Northern universities is becoming apprehensive that his credits in science will not be accepted by these institutions.

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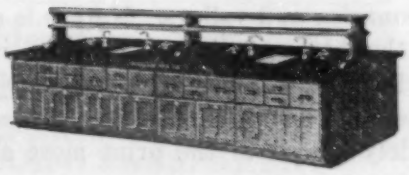

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the anti-evolution law by the next legislature unless public opinion is enormously changed. The present governor, who approved the bill and who is a candidate for reelection, has announced as part of his platform that he will veto any effort to repeal the law. His only antagonist claims to be the real author of the bill.

"The press of the state as a whole have given no assistance whatever to those who have led the fight against the bill.

"The sole hope of any immediate relief lies in the possibility of securing in the Scopes case a decision of the Supreme Court of Tennessee to the effect that the act is unconstitutional."

AMERICA'S NATIONAL PARKS

THE project for stressing the educational value of the American national park system, making it into a vast super-university of the out-of-doors, in which any thoughtful person may study, regardless of age or previous educational qualifications, will be discussed in an announcement of the National Park Association which will be issued in a few days.

The leading article in the number will be by Dr. John C. Merriam, president of the Carnegie Institution of Washington. After discussing the recreational side of national park activities, which is already well developed, Dr. Merriam will say, in part:

"As I have given something more than forty years to study of special problems such as the parks interpret, and have lived thirty of those years among the parks, I have some confidence in saying that for many purposes their purely educational value is far beyond that of any regularly established, formal educational institutions. Among the most important features are those which concern the nature of the earth—the manner of its building—the forces which have come into play—the meaning of the almost limitless history of earth-making as it is pictured before us. David said, in viewing the works of nature, 'The heavens declare the glory of God, and the firmament showeth his handiwork.' This work of the Creator's hand presents itself here in such a way that all may comprehend. Here is found also much that represents the unmodified primitive life of the world, both plant and animal, remaining just as the Creator moulded it over the mountains and valleys. Nature is said to be an open book to those who really wish to read it, but there are grades and shades of meaning which may be hard to understand. There is certainly no place where the leaves are more widely spread or the print more clear than in these portions of the book.

"With all that has been done by geologists and other scientific men, by central administration of the government, and by officials concerned with immediate administration of national parks, we have only begun to convey the really great lessons to the multitude. Science needs itself to know more fully what the story is, and then simplification and clarification must help to carry the great essentials over, so that the casual visitor may read and may interpret without depending upon the word of another. To attain such clearness of expression is to stand upon the highest plane of education. For many objectives this level can nowhere be reached so easily as in the national parks. There are not in America other places where, for these purposes, comparable possibilities for effective adult education concerning nature can be found, with the grandest products of creation themselves as teachers. For utilization of this opportunity we need support adequate to prepare for most effective use. In such a super-university professors would be only guides and not instructors, but there should be a faculty chosen from leaders in thought and appreciation, a group of men who, standing in the vivid presence of the Creator, would serve to point out the road."

ITEMS

NAMES of faint stars that are companions to brighter objects are suggested by Sir Oliver Lodge, even though these stars are too faint to be seen except with the most powerful telescopes. "Eddington" is the name suggested for the companion of Sirius, the "Dog-Star," since it has been found by Professor A. S. Eddington of Cambridge University, to be so dense that a single pint of it would weigh twenty-five tons. This has been confirmed by spectroscopic observations at the Mount Wilson Observatory in California. For the famous invisible star of Algol, the "Demon Star," Sir Oliver suggests "Vogel," after K. H. Vogel, the German astronomer who first proved its existence. This companion is dark and can not be seen with any telescope, but it makes its pressure known by periodically coming in front of the bright member of the pair and partly obscuring it.

CADMIUM plating is as effective in preserving iron and steel from corrosion as zinc, metallurgists at the U. S. Bureau of Standards find. Zinc plating or "electro-galvanizing" is especially valuable in commercial processes because it continues to act as a protection to the underlying iron or steel even when partially worn away. This is the result of an electro-chemical reaction between the base metal and the coating. The two in contact with a liquid such as a water solution of any chemical salt acts like a wet battery. Automobile parts subject to corrosion, such as rims, nuts and bolts, are common examples of electrogalvanized iron. Cadmium has been suggested for use in this way but it was not previously known just how it would react. The experiments carried out in the metallurgical division by H. S. Rawdon have demonstrated that it behaves in much the same way as zinc, with some advantages and some drawbacks. It is less readily attacked by air and moisture and in consequence stays bright longer than zinc. It could suitably replace nickel plating in many places and it would give much more lasting protection to the iron or steel base. Likewise a coating of cadmium will last longer than a coating of zinc of the same thickness. It has, however, the serious disadvantage of being expensive to prepare. It is possible that it may be made more cheaply if the demand is ever sufficient to stimulate large quantity production.

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SCIENCE NEWS

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THE TEMPERATURE OF THE PLANETS

IF, by means of a rocket or one of the various methods proposed by Jules Verne and other writers of scientific romances, men are able to travel to the moon, asbestos underwear will probably be a necessary part of the equipment, for when it is noon on our satellite, and the sun is directly overhead, the temperature is about 120 degrees Centigrade or 250 degrees Fahrenheit.

This is the conclusion of Dr. Donald H. Menzel, of the University of Iowa, who has made calculations of the temperatures of the moon and the planets based on observations of Dr. W. W. Coblentz and Dr. C. O. Lampland, at the Lowell Observatory. These results are described in an article to appear in the forthcoming issue of the *Astrophysical Journal.*

Martians, if there are any, do not freeze all the time, for according to Dr. Menzel's computations, the temperature of the equatorial regions of Mars rises as high as 75 degrees Fahrenheit when the planet is nearest the sun. Light areas on its surface are cooler than dark areas, even though on the earth the deserts, which would probably appear brightest to an astronomer on another planet, are the hottest parts of the terrestrial surface. However, the dark areas of Mars absorb more heat and light than the light areas, which reflect it away.

But, though any form of life that might exist on Mars would be comfortable when the thermometer is at its highest, it would have to withstand tremendous variations between day and night, for the temperature of part of the planet in the shade of night was found to be about 120 degrees below zero Fahrenheit. Like the earth, the poles of the planet are cold, for on August 14, 1924, the temperature of the south polar cap was about 150 degrees below zero, though it gradually increased until it was only about 5 degrees below on October 22. This indicates, it is stated, that the polar cap is probably composed of ice and snow.

Measurements have also been made of the temperature of the more distant planets, Jupiter, Saturn and Uranus, and their temperatures are found to be about 200 degrees below zero Fahrenheit, 240 below and 275 below, respectively. It is stated that there is little evidence of internal heat, although many astronomers have supposed that these planets, once presumably part of the sun, are still very hot.

The method by which the observations were made consists in the use of a thermocouple of two different metals which give rise to a small electric current when heat or some other form of radiant energy falls on it. This current is measured by a delicate galvanometer. The apparatus was attached to the 40-inch reflecting telescope of the Lowell Observatory, and by putting screens of quartz, glass, water and fluorite in front of the thermocouple, energy of various wave lengths was filtered out, and the amount of each of these components in the planetary radiation was measured.

THE LEAD TREATMENT OF CANCER

WITH thirty almost hopeless cancer cases apparently cured Professor Blair Bell's lead treatment comes well to the front, if not to the center, of the crowded arena of cancer research.

Of the 227 practically hopeless cases treated since November, 1920, 30 have been pronounced cured, in ten the cancerous growth has been arrested and nine are considered greatly improved. Dr. J. G. Adami, vice-chancellor of the University of Liverpool, in a comment in the English medical journal *Lancet,* in which Professor Bell's papers on the lead process of treating cancer have appeared, says that the thirty patients show no sign of lead poisoning or recurrent cancer, are in good bodily condition and are following their usual occupations.

The funds to carry on this line of cancer research have been furnished by private endowment and are administered by the Liverpool Cancer Research Committee of which Professor Bell is now director. In his efforts to find a preparation of lead that would react against the cancerous cells and not harm the surrounding tissue he has been assisted by the department of physical chemistry of the University of Liverpool.

This has proved to be one of the most serious problems of the whole method of treatment. Lead salts injected directly into the circulatory system are poisonous. Colloidal lead, with which the best results are obtained, consists of small particles of lead suspended in a state of more or less unstable equilibrium. The problem of the chemistry department of Liverpool has been to devise a method by which a lead colloid could be made more stable and effective. A group of scientists working under Professor W. C. McC. Lewis have been conducting a series of investigations which, while they have produced a considerable improvement, have not yet been able to make a preparation that will stay suitable for use for more than a few days.

As yet, according to the account in *Lancet,* the product is still so unstable and difficult to prepare as not to warrant the publication of the procedure necessary to make it. It is hoped that ultimately a permanent colloid will be perfected which will be then made available for use in the hands of clinicians carefully trained to administer it.

In his most recently published analysis of his results Professor Bell stresses the point that much work must still be done to make a more active preparation of lead that will be less poisonous to the system generally. All types of malignant growths, he declares, are probably amenable to the influence of lead if only enough of the metal can reach them.

He does not hesitate to employ auxiliary measures of surgery, X-rays or radium when circumstances seem to warrant but recommends that when the growth has been partly or apparently entirely removed, "intravenous injections of lead should be employed within a few days of the operation when possible."

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In conclusion he states that "the method of treatment is difficult, and to some extent dangerous and can only be safely employed by those who are thoroughly experienced in the work, and have laboratory facilities at their disposal."

TEACHING THE DEAF BY TOUCH

A WAY to show totally deaf persons that spoken language has rhythm is being tested by Dr. Robert H. Gault, professor of psychology in Northwestern University, who, under the auspices of the National Research Council, is conducting experiments upon students of Gallaudet College for the Deaf. The method has grown out of Dr. Gault's experiments in relation to sensation of touch. If it is put into use in schools for the deaf, it will help the child who has never heard the sound of spoken words to talk much more normally.

"The deaf person has great difficulty in grasping the idea of the swing of human speech," says Dr. Gault. "That is why his sentences often sound stiff-jointed and queerly accented. By means of apparatus which conveys the vibrations of a speaker's voice to the finger tip of the deaf person, he is able to catch the swing of the sentences and the grouping of words and phrases, and fine distinctions among words."

The apparatus used for these experiments is the same that Dr. Gault has used for some time in testing the practicability of enabling the deaf to understand speech by the way it feels upon their finger tips. The speaker talks into a transmitter, and the vibrations of his voice are amplified 175 times. The deaf listener, who may be in a different part of the building, holds in his hand a receiving device that looks like a radio earphone, and presses one finger against the disc to catch the vibrations. Different vowels and consonants have different vibrations, and one by one the student learns to identify the sounds that make up the language.

Some of the deaf subjects who have spent no more than 120 hours in the laboratory have learned to recognize several hundred words with their fingers. One succeeded in identifying 120 sentences without error, after having been over them but eight times, and others have done almost as well.

These subjects, Dr. Gault says, have now acquired a familiarity with the swing or movement of speech which they never had before. This is giving them a thrill of speech that they never experienced. They enjoy the movement of verse, some verses more than others. They can take a list of unfamiliar sentences and mark them to indicate how a good reader might read them. Subjects of corresponding age and school experience who have not taken part in any of Dr. Gault's experiments are approximately 28 per cent. inferior in this respect to the practiced subjects.

Dr. Gault also has his method in connection with lip reading, and he has demonstrated that the feel of speech is of practical use here.

"There are many different groups of words, each member of which looks like every other word in the group to the individual who is reading the lips of a speaker," he explains. "For instance, the words 'aim' and 'ape' look exactly alike as the lips form them. These syllables, however, are very different when they are felt by aid of the instrument in the laboratory."

The psychologist has selected 103 such groups at random for experimental purposes to discover how far the sense of touch can go in making distinctions among them. In only seven groups out of the 103 did he fail to find definite differences in feel—different enough to enable the subjects to make identification.

Because of the large number of words that are difficult to distinguish in unaided lip reading, he believes that learning would be easier for the deaf child if he could watch the teacher's lips and at the same time feel the words in his fingers.

"When the deaf in school can both see a speaker's face and feel his words and the movement of his speech, instruction can be very greatly speeded up without separating the pupil from the language of normally hearing people," says Dr. Gault.

RACIAL TYPES

MAN started his evolution with a stocky, solid body of medium height and moderately brunette complexion, and worked both ways from that beginning, according to Professor R. Bennett Bean, of the University of Virginia, who proposes a new system of classification of racial types in forthcoming issues of the quarterly *Review of Biology* and of *The American Journal of Anatomy*.

Professor Bean regards the primitive Neanderthal man of central Europe as the ancestor of the human race, and his physique is taken as the type of a medium-built body, or "Mesomorph." From this central type development took place in two directions, toward a long-legged, long-headed figure and toward a short-limbed, round-headed one. The former Professor Bean calls "Hypermorph," or "high-form," and the latter "Hypomorph," or "low-form."

According to the theory, changes in the body conformation took place when the descendants of the original "mesomorphic" men began their migration. Those who remained inland, under conditions more or less similar to those of their first home, retained their medium structure. Those who migrated to the coastlands developed the longer and rangier "hypermorphic" characteristics under their new environment. Those who wandered southward and southeastward toward the tropics, or northward into the Arctic zone, got into regions more or less unfavorable for the best human development, and, in Professor Bean's words, "were reduced to a more or less infantile form, with short arms and legs and round heads and faces. This finds its extreme manifestation among the Negrillos of Africa, the Negritos of the Pacific, and the Malays, and in a more or less modified form among the peoples of the sub-Arctic regions, as the Siberians and the Lapps."

Professor Bean's new system of classification does not run parallel with the older arrangements of the divisions of the human race, but cuts right across them. In the white race there are both mesomorphs and hypermorphs,

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THE RESTORATION OF THE SPHINX

VISITORS to Egypt now have the opportunity to obtain an unobstructed view of the front of the Sphinx, including its feet which are on exhibition for the first time in forty years. The Egyptian Government, according to advices reaching Paris, has undertaken not only to clear away the ever-mounting desert sand but also to make much-needed repairs on the venerable genius of the Nile.

The clearing away of the tons of sand and gravel necessary to uncover the Sphinx completely involves so much labor that it was undertaken but three times during the nineteenth century, the last excavation occurring in 1886. A veritable army of fellaheen is required to remove sand by the basketful to a point far enough away so that it will not immediately blow back and render their labor useless. It is recorded by medieval travelers that sometimes only the head of the image has been visible over the shifting sands of the desert.

Between the feet there is now on view the stele, or sculptured tablet of Tahutmes IV, on which is recorded a dream that came to that monarch while taking a noonday nap in the Sphinx's shadow.

Archeologists are somewhat disturbed by several cracks that have previously escaped notice in the rock from which the image is carved. These are being filled under governmental direction with a specially prepared cement. The explanation has been offered that they have been caused by seepage from water that has collected in a hole about three feet deep at the top of the head.

There are various legends about this hole. Some say it is merely a tomb shaft, while others have fruitlessly investigated it with the idea of finding entrance to subterranean treasure chambers.

The French Egyptologist, Hippolyte Boussac, has suggested that the hole was designed to hold the base of a gigantic headdress, such as the Egyptian god Osiris is usually depicted as wearing. It may either have been lost, he says, or never finished like some of the European cathedrals which are lacking a tower or two of the original design, several of them, to this day.

ITEMS

THE Prussian Lower House has passed a credit of $120,000 for the purpose of having a scientific investigation into a mysterious disease which is affecting fishermen in that part of the Baltic known as "The Häff." The seizure comes suddenly, without warning, when at sea. It consists in severe pains in the muscles of arms and legs, culminating in temporary paralysis of these limbs. The attack ceases within a few hours after the patient is once more on land, but is apt to break out afresh as soon as he goes out to sea again. The theory has been put forward by a British specialist that the disease is a result of chemical deposits proceeding from the outflow of waste from the Stinnes chemical works along that part of the coast, but a very thorough chemical investigation will have to be made before the truth of this can be ascertained.

THE importance of cutting out a definite course for a vocational career and then steering by it is shown by a survey of office workers who applied for jobs at a typical employment bureau. The results, as recently reported by Dr. Harry D. Kitson, of Columbia University, show the educational and job histories of 684 applicants for work. The most striking fact discovered was that 40 per cent. of the men and 12 per cent. of the women were dissatisfied with their choice of occupation and wanted to change to other fields of work. Dr. Kitson states that the histories of such workers as these, none of whom he had guidance in selecting or planning their careers, constitute a plea for educational and vocational guidance.

THE losses of the wheat crop due to the Hessian fly will probably be much smaller than usual this year. According to the report issued by the U. S. Bureau of Entomology of a survey of the wheat-growing states, this insect is at a very low period of its abundance throughout the country. Illinois and Kansas alone show serious infestation, which is attributed to too early sowing and auspicious weather conditions at the time of the insects' emergence in the fall. Dissemination of information about the life-history of the Hessian fly by state and county authorities and cooperation of the farmers in deferring planting until the fly-free date in late September, as well as unfavorable weather conditions, are cited as causes for its decreasing prevalence.

CONTINUED freezing apparently can not kill bacteria that cause typhoid. Professor M. J. Prucha and J. M. Brannon, of the department of bacteriology of the University of Illinois, kept a colony of typhoid germs in a sample of ice cream at a temperature averaging four degrees below zero for two years. From time to time samples were taken out, for all of which positive cultures were obtained. The number of bacteria decreased gradually, it is true, but as many as 11,000 living typhoid bacteria survived in the final sample at the end of two years. In their paper in the *Journal of Bacteriology* the authors conclude from these results that low temperatures can not be relied upon to destroy typhoid germs in ice cream. They do not attempt to explain the resistance of the organisms to low temperature but there is indication, they say, that the kind of medium in which they are grown is an influential factor.

RE-GROWTH of the severed spinal cord in the higher vertebrate animals, a paralyzing injury from which recovery has hitherto been considered impossible, has been accomplished in the physiological laboratories of the University of Chicago. Dr. R. W. Gerard and Dr. Theodore Koppanyi cut the spinal cords of the unborn young of rats, which were later brought into the world not only alive but apparently none the worse for their operation. Commenting on the experiments, Professor A. J. Carlson, head of the department of physiology, said: "Regeneration of the injured or severed spinal cord is known to take place in the lower vertebrates—fishes and frogs—but regeneration in the central nervous system of mammals is unknown or uncertain. These experiments may thus form the starting point for a reinvestigation of this important problem in the higher animals."

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SCIENCE NEWS

Science Service, Washington, D. C.

THE DALLAS MEETING OF THE AMERICAN MEDICAL ASSOCIATION

THE American Medical Association began its sessions at Dallas, Texas, on April 20, with some six thousand physicians present.

The chief rôle of the family physician of the future will be to keep his patients well rather than to treat them when they are sick. Preventive medicine and public health education were the text upon which Dr. Wendell C. Phillips, the newly-installed president of the association, based his address at the opening session of the annual meeting of that organization being held in Dallas this week.

Complete eradication of measles, whooping cough, scarlet fever, possibly all the eruptive diseases, as well as all the insect-borne plagues, is a potential development of the future pictured by Dr. Phillips.

The physician of the past, he said, was educated to treat disease. He knew little of preventive medicine, sanitation or hygiene, fields in which national, state and municipal departments have become powerful and controlling factors. The health measures of great industrial organizations, pay clinics and group practice have of late years brought great health benefit to hundreds of thousands.

The publicity work of all these agencies has gradually created a demand from the public for more information about personal health, which should be met by a wide and comprehensive plan of personal and public health education of which the educated physician should be the source and head. Much pressure is being brought to bear at the present time to break down the reticent attitude of the medical profession toward the press. The House of Delegates of the American Medical Association is on record as favoring every measure of public health education and the better class of publications has given its cooperation by publishing only material of this character that has received medical approval.

Periodic physical examination of the healthy as well as the sick is a preventive measure strongly endorsed by the medical profession in the general program of health preservation.

"The family physician of the future," said Dr. Phillips, "must educate his patients and community in preventive medicine and be to some extent a health administrator. His chief rôle and his chief service will be to keep his patients well. Evidently, such service can be made possible only by maintaining intimate, clinical information, well recorded, regarding every man, woman and child who seek his service. And every man, woman and child in every community should have his health recorded in the files of his family physician. Too many of our inhabitants worry through life with only fairly good health, and while they accomplish their daily duties, these fairly well persons may never know the exuberance and happiness of perfect health. Hence, one goal of the future practitioner of medicine will be the attainment and maintenance of exuberant health, which is the inherent right of every person. A higher average of overflowing good health means a higher average of happiness, comfort, usefulness and economic value of the individual. The superman will never materialize without superhealth."

Medical education, Dr. Phillips went on to say, will place more emphasis on the human side and less on the mechanical and technical side than at present. The curriculum of the undergraduate should be extended to include health conservation and the application of the principles of science through the personal relations of the physician and patient.

The address closed with a tribute to the importance of the general practitioner as a factor in the nation's health life and the significant statement that while the service rendered by a physician may not be considered in terms of finance it should be remembered that health conservation is of greater value than the sums paid out for helping the body repair the ravages of disease.

PAPERS ON THE PROGRAM

PREVENTIVE medicine has scored a real triumph over diphtheria. A survey of the mortality statistics of this once deadly disease reported to the association shows that in 1910–14 only thirteen cities averaged death rates under 10 per 100,000; in 1915–19 only eighteen cities could be so classed; but in 1924 there were thirty-seven and in 1925 forty-nine with diphtheria death rates lower than had ever been known before 1910. There is little doubt but that this amazing reduction can be attributed largely to the increasing practice of immunizing school children with toxin-antitoxin mixtures or with anatoxin. This opinion seems to be borne out not only by observation in single cities like New York where this method has been extensively used, but by the rapid decline in diphtheria mortality throughout the country. Antitoxin, as a curative agent, is due considerable credit but the fact that the death rate has dropped so decisively since the immunization measures have been applied indicates that it is the main factor. According to editorial comment in the *Journal* of the American Medical Association, diphtheria may be an almost negligible factor in the mortality returns of 1930, if the improvement of the last three years continues.

THE active principle of the ovary, or female sex gland, is now being used in treating women for several different diseases. Dr. J. P. Pratt, of the Ford Hospital in Detroit, and Dr. Edgar Allen, of the University of Missouri, gave a report of their most recent observations on the ovarian hormone. It is believed that this substance has an influence on the periodic functions of women. It has not yet been definitely established whether these functions are also controlled by other secretions in the body or by the same substance derived from other sources. This

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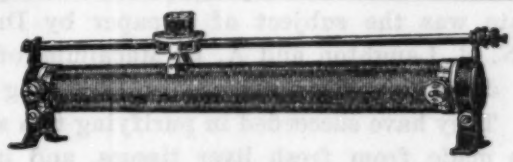

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principle has been used in the study of the physiology of women whose ovaries have been removed and is said to produce a quite definite effect in such cases.

INJECTION of chemicals and certain dyes directly into the veins is useful in combatting generalized infections according to Dr. Hugh B. Young, of Baltimore. Hundreds of successful treatments were cited involving such affections as boils, erysipelas, infections of the joints and abscesses.

An investigation of chorea, commonly known as St. Vitus's dance, a complaint of childhood characterized by twitching of the muscles and convulsions of the body generally, was reported by Dr. Franklyn E. Ebaugh, of Denver. He found that this disturbance frequently followed in the wake of infections. While it has some organic basis the symptoms are aggravated, he determined, by insufficient diet, high altitude, or disturbances of the brain.

The social and economic aspects of mental diseases have never been sufficiently stressed, according to Dr. Theodore Diller, of Pittsburgh, in a talk before the section on diseases of the nerves and the mind. Neurologists, he declared, have concerned themselves too exclusively with the scientific side of mental disease. The social and economic bearings of such a condition are of vast importance, he maintained, and physicians should give more consideration to these points before making diagnosis.

"If a child has been trained to meet reality," said Dr. M. S. Gregory, of Oklahoma City, in a paper before the same section, "then as an adult he or she will meet reality and remain well." Hysteria in grown-ups, he said, is the reaction of a child to conditions outside his control. If a baby gets what it wants by a "tantrum" when young, he reacts in the same manner when grown. In other words, such people stay babies in this respect unless they receive the right training, as children.

People die with cancer of the stomach, said Dr. George B. Eusterman, of the Mayo Clinic, in an address to the section devoted to diseases of that organ, because over half of them wait until it is too late for an operation before they consult a physician. Eighty per cent. of such patients are men, while over sixty-five per cent. of them are from fifty to seventy-five years old.

THE recently discovered liver extract used in reducing blood pressure can now be prepared in a comparatively pure state was the subject of a paper by Drs. A. A. James, N. B. Laughton and A. B. Macallum, of London, Ontario, describing their method of preparing the new remedy. They have succeeded in purifying this substance, which is made from fresh liver tissues, and in freeing it from dangerous chemicals. When injected into the body there occurs a rapid fall in blood pressure more pronounced and of longer duration than can be induced by any other known drug.

Dr. W. J. MacDonald, of St. Catharine's, Ontario, who has been working on liver extracts independently, described their application and their use.

Dr. Ralph C. Major, of Kansas City, described another substance called "guanidine" which produces a rise in blood pressure when injected into the body. A decided elevation in blood pressure was produced in dogs by extracts made from several different organs of the body. That made from liver was found, however, to be more efficacious than anything else as a depressant. It is thought the method will eventually have great practical value in the treatment of this condition in human beings.

Dr. Joseph L. Miller, of Chicago, pointed out that there are many types of blood pressure that are due to changes in age and in these cases high blood pressure is possibly a necessary phenomenon. There is such great variation in blood pressure at different times even in the same person, he said, that the study of the effect of the various types of treatment is a difficult matter. Dr. Miller also indicated certain changes which are caused by emotional disturbances, by rest and sleep, and even by nightmares during sleep.

VERTIGO and dizziness comprise the latest addition to the ills for which we should be psycho-analyzed. In a paper delivered before the Throat, Ear and Nose Section of the association, Dr. Dana W. Drury, of Boston, recommended for giddiness the mentally analytical methods popularly associated with the famous Austrian, Freud. Dizziness was on the throat, ear and nose program, because the fluid of the semicircular canals of the ear is the source of the sensation of vertigo. It has previously been thought that it might be an indication of something wrong with the glands of internal secretion. A study of 1,100 cases, however, has disproved this theory completely. In one third of the patients causes of this condition were found that were quite unrelated to the ductless glands.

VERY unusual symptoms have been developed in diabetes cases when the necessarily restricted diet has failed to include vitamins A and B. Grave danger has resulted from the choice of diets for such patients not under the careful supervision of a physician. Dr. Michael Wohl, of Omaha, brought about much discussion in the section on pathology and physiology by bringing to light these new facts. Many cases were reported in which the importance of vitamins had been overlooked by patients on special diets.

THE sugar we eat may have a definite bearing on the ability of our joints to resist infection. Dr. Ralph Pemberton, of Philadelphia, speaking of diseases of the bones and joints said that the amount of sugar digested in the body has a well-defined relationship to inflammation of the joints. In more than sixty persons with disturbances of the joints he found a low tolerance for sugar. Dr. Pemberton believes that control of sugar digestion is a factor in the healing of such diseases. The condition is not the same as that which occurs in diabetes, but seems to depend on some changes in the circulation of the blood. Low sugar tolerance was produced experimentally in individuals by changing the circulation through the administration of drugs. By these studies it was determined that sugar taken in through the mouth passes by way of the blood to the fluid of the joints and there is evidence indicating that it aids their resistance to infection.

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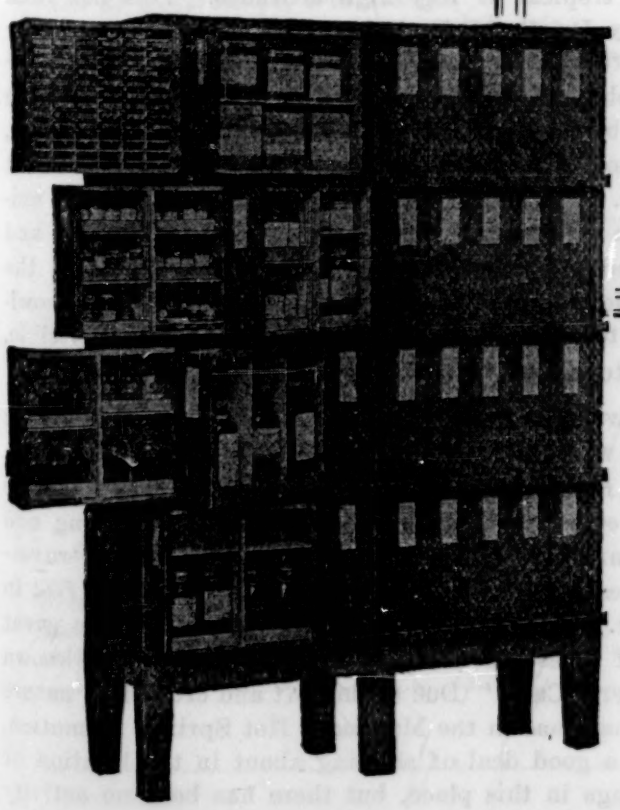

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CANCER is on the increase in the lungs as well as in all the other organs, according to a report by Drs. John A. Lichty, F. R. Wright and E. A. Baumgartner, of Clifton Springs, N. Y., who presented figures to show that while cancer of the lungs is increasing along with cancer of all parts of the body it occurs proportionately less often in the lungs than in any other organ. These views are in direct contrast to those of other observers who maintain that the inhalation of tar and oil particles and the irritation of the lungs following influenza have brought about a marked increase in the number of cases of cancer of the lung tissues. There is no actual proof that the influenza epidemic has had any definite relationship to the growing amount of cancer of the lungs.

IT is possible that many people have developed immunity to infantile paralysis through having been mildly infected on some previous occasion. Dr. W. L. Aycock, of Boston, stated that while this disease undoubtedly spreads from person to person, there are some instances in which it may not be due to either direct contact or through a carrier not suffering from the disease. It has been found that it may be transmitted through milk or some other indirect method.

ONLY half of those dangerously color blind are eliminated by the usual tests used to select applicants for train, yard and engine service on railways, according to Dr. Archibald Chace, chief surgeon of the St. Louis Southwestern Railway Lines. He maintained that the devices simulating a lantern were the only type suitable for such tests. The ordinary field tests were of little value because they were made under ideal conditions and not such as would arise in emergencies and result in accident. They should be made under all the circumstances of steam, rain, fog, smoke, daylight, night or dawn that would arise under natural weather conditions by methods planned in advance to cover the 288 possible ways under which signal lamps or flags may be observed, he declared. Dr. Chace, who has had seven years of experience in supervising the examination of applicants for hazardous occupations, emphasized the fact that tests for color blindness require great expertness in their administration in order to achieve their end. He urged that the stations at which such tests are made be reduced to the fewest practical number and that the work be checked periodically. He also made a point of distinguishing between color blindness and color ignorance. "From the standpoint of safety," he asked, "what difference does it make if the engineer can distinguish colors clearly by comparison, if he calls a red light yellow, or a green one blue?"

ITEMS

MISSISSIPPI'S new anti-evolution law already faces a challenge on the part of the American Civil Liberties Union, the organization that undertook the defense of John T. Scopes in the famous Dayton anti-evolution trial last summer. Arthur Garfield Hays, member of the Scopes defense counsel, has informed Science Service that the organization is contemplating a test case, but will attack this time by means of a taxpayer's suit, which, though it offers less possibility of the spectacular proceedings that marked the Dayton trial, at the same time affords a better opportunity for a thorough-going legal test, free from extraneous appeals to religious prejudice and mob emotions. "In bringing such a suit," said Mr. Hays, "it is of course necessary that the initiative be taken by a citizen and taxpayer in the state affected. We are now in communication with a number of interested persons in Mississippi, and as soon as we shall have made the proper arrangements we shall take action." Mr. Hays also stated that the appeal in the Scopes case is still pending before the Supreme Court of the State of Tennessee, but that a hearing may be had some time during May.

THE discovery of super-X-rays, consisting of extremely short-wave radiations coming to the earth from outer space, possessed of tremendously high penetrating power, has been confirmed by two Russian scientists, Dr. L. Myssowsky and Dr. L. Tuwim, who have repeated parts of the experiments performed by Dr. R. A. Millikan in the United States and by Dr. Kolhorster, the German pioneer, in super-X-ray research. Tests were made of the penetrating power of the rays by sinking specially arranged electroscopes beneath the waters of Lake Onega in western Russia, and found that the rays were quenched at a depth of 19 meters, or about 60 feet. This was the depth determined by Dr. Millikan in California mountain lakes, and by Dr. Kolhorster in the Bosphorus during the World War. Waves able to pass through this depth of water, plus the thickness of the earth's atmosphere through which they come on their way from outer space, have a penetrating power, according to the physicists' calculations, that would carry them through six feet of lead.

ACCORDING to Dr. H. H. Turner, professor of astronomy at Oxford University, the atmosphere becomes warm, and actually tropical at very high altitudes. This has been shown by Dr. G. M. B. Dobson, lecturer in meteorology at Oxford, and F. A. Lindemann, professor of experimental philosophy at the same institution, and was made possible by the observations of meteors by W. F. Denning, of Bristol, who has been observing meteors for about 40 years. Professor Turner points out that though aviators can only go a few miles off the earth's surface, and unmanned pilot balloons can go to about 20 miles, the observations of meteors, or shooting stars, extend knowledge up to about 50 miles, when they first become visible, after entering the atmosphere from outside space.

A NEW hot spring has broken out at Mammoth Hot Springs, where the park headquarters are situated, according to a report from Park Naturalist E. J. Sawyer. The new jet comes through a vent about two inches long and three quarters of an inch across, and is depositing travertime limestone over an area varying from 25 to 35 feet in diameter. It is located on the lower part of the great group of limestone terraces, near the rocky cones known as "Liberty Cap." Due to the soft and crumbling nature of the limestone in the Mammoth Hot Springs formation, there is a good deal of shifting about in the location of the springs in this place, but there has been no activity in this particular section of the formation for twenty years or more.

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Chief subjects in which research work has been published or is now in progress

SCIENCE NEWS

Science Service, Washington, D. C.

THE MEETING OF THE AMERICAN PHILOSOPHICAL SOCIETY

THE American Philosophical Society held its annual meeting in Philadelphia on April 22, 23 and 24. Among the scientific papers presented are the following:

ONE of the least known sections of the spectrum has been investigated by Professor K. T. Compton and C. H. Thomas, of Princeton University. Professor Compton described the methods they have used to make more accurate measurements of the spectral region that lies between ordinary X-rays and the extreme ultra-violet than have hitherto been possible. Except for a small region between radio and heat waves this is the only part of the spectrum that has not been capable of receiving close and accurate study. Professor Compton and Mr. Thomas have shown that in this region of very soft X-rays iron, cobalt, nickel, carbon, copper and tungsten give out numerous characteristic radiations. In the other regions of the spectrum, such as the ultra-violet section measured by Professor R. A. Millikan, the radiations themselves can be more or less directly studied, but these very soft X-rays are so strongly absorbed and so little reflected that workers must resort to very indirect methods for their detection, such as the photo-electric methods described by Professor Compton.

THERE is much yet to be learned about the curative powers of ultra-violet light, the rays of sunlight which cause sunburn. "It is certain," said Dr. Alfred Hess, of Bellevue Hospital, "that ultra-violet rays bring about a retention of inorganic salts in the body thus helping to maintain the bony structure." As a result of this function, ultra-violet light rays, either produced naturally by the sun or artificially, have been found helpful in the treatment of rickets. During and immediately following the world war rickets or its counterpart, the so-called "hunger osteomalacia or war osteopathy," ravaged the peoples of central Europe, Austria, Germany and Poland. This was due almost entirely to insufficient food. Had it been known then that this malady could be prevented or cured merely by exposure to sunlight, much suffering could have been avoided. The calcifying properties of foods subjected to ultra-violet radiations, which have been successfully used to prevent various disorders of the bones, are due to the cholesterol or phytosterol they contain. As every cell of food so treated contains one or the other of these substances the wide application of this indirect use of ultra-violet rays is evident. The anti-rachitic vitamin has actually been made in the laboratory artificially, Dr. Hess went on to say, by treating the chemical substance cholesterol with ultra-violet radiations. This has not been accomplished in relation to any of the other vitamins.

WHAT becomes of uric acid? This is a question that Professor Withrow Morse, of the Jefferson Medical College of Philadelphia, has set himself to answer, and in a paper before the society he discussed some of the aspects of this vital physiological problem. The dietary factor operates to increase uric acid troubles in Europe more than in this country. This is due somewhat to the fact that here we take less alcohol with our meals. Uric acid has an interest more than purely medical because it represents the end product of chemical changes in the cells concerned with sex and heredity. Recent work has shown that while a little uric acid is carried off by the organs of excretion much of it is destroyed in the blood. By means of a color test, Professor Morse has demonstrated that one of the products into which it resolves itself can be found in the blood of some animals but not in others. For instance, the blood of herbivorous animals contains none of this substance, which is called allantoin, and that of human beings has a very slight amount. Professor Morse is now working on a method by which he can determine just how much of the uric acid products can be found in body fluids.

THAT the body of an animal becomes a well-behaved, well-policed unit instead of a mere anarchic mass of cells and tissues is due to invasion and conquest of its growing parts by the branches of motor nerves, is the theory put forward at the meeting by Dr. G. E. Coghill, who worked at the Wistar Institute of Anatomy and Biology. Earlier workers have held an opposite view, that the activities of the growing parts caused the nerve branches to enter and develop in them, Dr. Coghill said, but his studies have convinced him that order is brought out of the chaos of growth by the initiative of the nervous system.

SCIENTISTS are now trying to measure the rate at which the nervous system reacts to external heat and cold. Professor H. S. Bazett, of the department of physiology of the University of Pennsylvania, has introduced thermo-couples, delicate devices that give a minute electric current when heated, underneath the skin. He finds that the temperature changes in the tissues are greater on a cold day than a warm day. There is no evidence to show, he said, whether this change is the cause of the temperature sensation or the reaction to it.

WHEN you sail for Europe on a trans-Atlantic liner you may be able in the future to tell whether or not a storm will strike the ship, according to Professor William H. Hobbs, of the University of Michigan, who spoke of the plans of the university's Greenland expedition, which will soon start out. "Its primary purpose," he said, "will be the quantitative study of the air circulation above and about the ice-cap of Greenland. This ice-cap is the vast refrigerating area within the Northern Hemisphere which functions as the Northern Wind Pole of the earth, and is therefore the breeding-place of the storms over the Northern Atlantic and Europe. Weather stations will be set up at strategic points both over and out-

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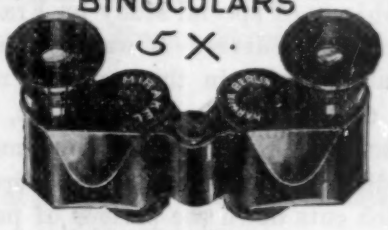

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side the ice-cap, those of most importance being necessarily at elevations in excess of 3,000 feet. Equipped with radio it is believed that from the main station warning can be sent out two days or more in advance of the arrival of the greater storms on the coast of Europe.''

PREDICTING weather accurately months or even years in advance has long been the dream of meteorologists, but we have not yet achieved complete success, said Professor Robert DeC. Ward, of Harvard University, in describing various methods which have been used in an attempt to make such forecasts. ''Among the attempts to predict weather in advance are the general predictions based on the habits and characteristics of animals; the almanacs which merely contain statements of the average weather conditions of past years; forecasts based upon sequences in the weather, and the forecasts for a year ahead which rest upon no scientific foundation and are without value. The story is told of a certain widely-known American 'weather prophet' who died not many years ago. It is reported that when his health was failing a certain patent-medicine company which had been using his prophecies for advertising purposes offered him a considerable sum of money if he would make forecasts fifty years in advance!'' He also told of the work of Mr. H. H. Clayton, formerly of the Argentine weather service, in making long-range predictions upon solar observations by the Astro-Physical Observatory of the Smithsonian Institution.

WHEN the eastern part of North America and most of northern Europe were thickly blanketed with ice, a hundred thousand years ago or more, the glaciers played four return engagements. Four different series of moraines or glacial hills mark the farthest south of the ice sheets, and these have been the objects of special study by Frank Leverett, of the U. S. Geological Survey. It was formerly held that the third morainal series in the east did not correspond in time with the third series in the west, so that it was supposed that the ice had been here five times. However, the recent studies have shown that the correspondence does exist, which cuts down the periods of past refrigeration to four, and makes the American series correspond with the European, where four periods have been definitely accounted for.

THE WELDING OF METALS

METHODS of welding metals together will be revolutionized by two new inventions of the research laboratories of the General Electric Company, for after years of search it is now possible to weld so that the fused metal is as strong and as ductile as if it were never in two pieces. Previous methods, using an arc to furnish the intense necessary heat, resulted in the formation of compounds of the metal with oxygen and nitrogen so that the weld was not as strong as the rest of the piece.

As the nitrogen and oxygen which unite with the metal come from the air, in these new processes the air is excluded when the weld is being made by a bath of hydrogen, water gas, wood alcohol vapor, and others which do not easily form metallic compounds.

One of the methods was developed by Dr. Irving Langmuir, assistant director of the Schenectady laboratory, and makes use of what he calls flames of atomic hydrogen, based on a discovery of Dr. R. W. Wood, professor of experimental physics at the Johns Hopkins University. Electric currents of twenty amperes and at voltages ranging from 300 to 800 were passed through two tungsten rods so as to form an arc similar to the arc between carbon rods in a street arc light.

By passing a stream of hydrogen gas into the arc from a small tube, an intensely hot flame is produced, because the molecules of hydrogen are broken up by the temperature of the arc into their constituent atoms. As the ordinary form of hydrogen is that of molecules, the atoms almost immediately recombine, but in doing so they liberate great amounts of heat, about half again as much as the oxy-hydrogen flame.

Iron rods an eighth of an inch in diameter melt within a few seconds when held about an inch above the arc, says Dr. Langmuir. Metals even harder to melt than iron, such as tungsten and molybdenum, one of the most refractory substances known, melt with ease. Quartz, however, melts with more difficulty than molybdenum, which Dr. Langmuir suggests as being due to the fact that the metals act as a catalyzer or a substance which speeds up a chemical change.

''The use of hydrogen under these conditions for melting metals has proved to have many advantages,'' according to Dr. Langmuir. ''Iron can be melted or welded without contamination by carbon, oxygen or nitrogen. Because of the powerful reducing action of the atomic hydrogen, alloys containing chromium, aluminum, silicon or manganese can be welded without fluxes without surface oxidation. The rapidity with which such metals as iron can be melted seems to exceed that of the oxy-acetylene flame, so that the process promises to be particularly valuable for welding.''

The other method of producing ductile welds was developed at the Thomson Research Laboratory of the General Electric Company at Lynn, Mass., by Peter Alexander, independently of Dr. Langmuir's work. The electric arc is passed between the metal to be welded and an iron electrode, and the gaseous atmosphere is supplied in the form of a stream around the arc, so as to keep it entirely away from air. Pure hydrogen, water gas, methanol or wood alcohol vapor, or dry ammonia can be used, as well as a mixture of hydrogen and nitrogen, for it is found that the nitrogen is not harmful unless oxygen is also present. All these mixtures contain hydrogen, and Dr. Langmuir suggests that this method also depends in part for its efficacy on the disintegration of hydrogen molecules into their atoms.

THE GERM THEORY OF CANCER

THE germ that causes cancer, if there is one, has not been discovered yet. Dr. James B. Murphy, of the Rockefeller Institute for Medical Research, has repeated the experiments of Dr. W. E. Gye and J. E. Barnard which attracted such wide attention last summer and in a report of his results about to appear in the *Journal* of the American Medical Association he holds his experiment refutes

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their contention that chicken tumor is caused by a micro-organism.

The English scientists reported that they produced tumors in chickens by injections of the filtered juice from chicken tumor in the presence of a second chemical factor. They also produced tumorous growths in chickens with filtrates from malignant growths from other animals —mice, rats and even human beings, in the presence of this second factor. This necessary secondary element was nothing else than filtered juice, or filtrate of chicken tumor treated with chloroform. None of these substances would produce a tumor or cancer when used alone.

By means of a complicated ultra-microscope employing ultra-violet light they studied the cell-free filtrate and detected the presence of a micro-organism which they believed was the causative agent of cancer.

A cancer consists of rapidly subdividing cells that keep on growing and will not stop. Such a condition of normal growth is found in the rapid cell subdivision of an embryo. At the Rockefeller Institute it was decided to try to produce a cancerous growth with a filtrate from embryonic tissue used in the same way as the juice from the malignant growths. In accordance with this idea the filtered juice from ground-up bits of chick embryo and rat placenta were injected into hens along with the chloroform-treated filtrate of chicken tumor and it was found that cancer resulted just as it did following the injection from malignant growths.

Dr. Murphy says in explanation:

"Apparently the power to activate a chloroformed filtrate can not be considered as proof of the action of a living organism, for cultures of embryonic tissue or placenta are just as potent in this respect as so-called cultures of malignant tissues.

"Two possibilities present themselves in explanation of the results attained. First, that the causative agent of the chicken tumor is in the nature of an enzyme-like substance which is inactivated by chloroform and may be reactivated by a diffusible substance from malignant tumors, embryonic tissues and placental tissues. The second possibility is that the chloroform treatment does not destroy but simply attenuates the causative agent to a point at which unaided it is too weak to induce a tumor but in conjunction with some injurious or stimulating substance supplied by the 'culture' it becomes effective. The fact that a great excess of chloroform so completely destroys the agent that no reactivation is possible is rather in favor of the latter possibility. Further experiments are in progress to elucidate these points."

THE PREVENTION OF PNEUMONIA

A POSSIBLE means of curing and preventing pneumonia is the result of a new method discovered by investigators at the University of Chicago, by which, with the aid of electrical instruments, it is possible to determine the chance a patient has of recovery and how much of death.

This discovery is the culmination of a series of experiments which have been in progress for the last six years, under the active supervision of Dr. I. S. Falk, professor of hygiene and bacteriology, who is also director of surveys of the Chicago Health Department. He was associated in his work with M. A. Jacobson and H. A. Gussin. The first experiments were carried out at Yale University.

Among the first experiments was one which attempted to develop a method of measuring the killing power of pneumonia germs. The investigators chose white mice as substitutes for men, and in the investigation which followed they found that if the germs were grown in a certain way they would kill mice in much the same manner as they kill human beings.

In determining how much killing power was required in each culture in order to cause death, and how to measure the susceptibility of the germs to clot together and become agglutinated, it was found that the most potent germs are most resistant to clotting. Working on the assumption that clotting is determined by the electrical voltage between germs and the suspending solution, they built an apparatus for accurately measuring this voltage.

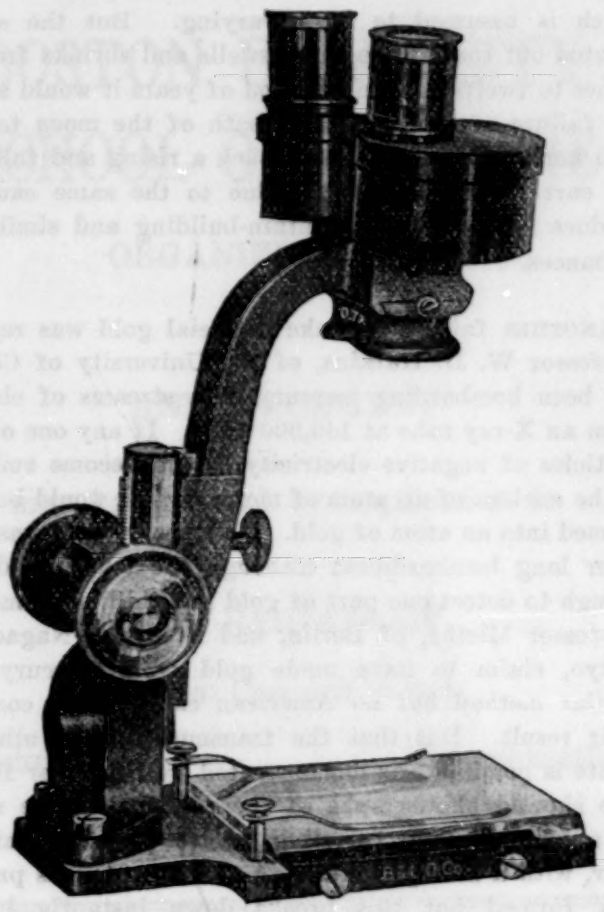
Through a series of similar experiments they demonstrated that the measurement of voltage on the germs is more rapid and simpler than measuring the killing power for injected animals. They thus made a discovery and improved its application simultaneously.

The same investigators have, in addition, developed methods of changing the virulence of pneumonia germs, and are able to increase or decrease this factor at will. This is said to be a distinct contribution to the study of these bacteria, for it had not been possible heretofore to retain their killing power after they had been removed from a patient and grown on artificial foods in the laboratory.

ITEMS

A HAWK that hunts snails is the unusual Florida bird discussed in the *Auk*, publication of the American Ornithologists' Union, by Donald J. Nicholson, of Orlando, Fla., who has made a detailed study of its nesting habits. The name of the bird is the Everglades kite, and it is found over a large part of the State of Florida. It likes to hover low over its marshy hunting ground, or perch on a post or stump, watching for its creeping prey. Once it spies a snail it swoops down upon it and deftly picks it off the plant on which it is feeding. It is able to extract the snail without breaking the shell, sometimes even performing this feat on the wing. More usually, however, it bears its prey back to its roosting place, which may frequently be recognized by the large number of empty snail shells scattered about it.

THE cotton boll-weevil, one of the worst enemies of American agriculture, threatens to be unusually numerous this year, according to U. S. Department of Agriculture scouts sent out against the armies of insect pests. Both in the older cotton regions of the South and in the Arizona fields the overwintering insects have been found in considerable numbers. At Tallulah, Louisiana, an examination of Spanish moss, in which the weevils usually take shelter for the winter, disclosed 280 of them per ton of moss, as compared with 16 per ton in 1924, 229 per ton in 1923 and 137 in 1917.



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SCIENCE NEWS

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THE NATIONAL ACADEMY OF SCIENCES

Telegraphic reports of the Washington Meeting by Dr. Edwin E. Slosson

DEATH-DEALING rays of soundless sound waves were demonstrated before the academy by R. W. Wood and Alfred L. Loomis, of Johns Hopkins. Professor Wood is famous for his success in dealing with light waves beyond the reach of the human eye, and such ultra-violet rays have proved useful alike in detecting false gems, imitation paintings and camouflaged batteries. Now he has turned his attention to sound waves beyond the range of the human ear, and nobody can foretell what will come of such discoveries. The new waves are generated in air or water by a plate cut from a quartz crystal and set into vibration by a powerful alternating electric current. These waves have a frequency ranging from one hundred thousand to four hundred thousand vibrations a second, and therefore lie two or three octaves above the highest note that can be heard by humans. What they would sound like if we could hear them we can not even imagine, but they make their presence perceived in various strange ways. In water these silent sound waves are less than half an inch long and travel much faster than in air. They heat the water as they pass through and their shock is sufficient to kill small fishes, worms and microscopic marine animals in less than a minute. The surface of the water is heaped up in a mound when a beam of these frequency waves is directed toward it. When a hand is thrust into the path of the rays in water the flesh tingles and the blood circulates more swiftly. This stimulating effect may be found useful in the treatment of certain diseases such as gout.

THE hardest blow that Einstein's theory has yet received has come from Professor Dayton C. Miller, of the Case School, Cleveland, who has repeated the famous experiment made by Michelson in 1887 on which the theory of relativity was based. Michelson was unable then to detect any drift in the ether due to the movement of the earth through space, but Miller's recent experiments with an improved apparatus on Mount Wilson shows evidence of ether-drift such as would be produced by a movement of the solar system in the direction of the Dragon constellation amounting to 124,200 miles a second.

IS our standard of time fixed? Does the length of the day vary? Does the earth expand and contract? These questions were raised by Ernest W. Brown, of Yale. Hitherto astronomers have blamed the inconstant moon for her failure to come to time on eclipses according to their calculations, but according to Professor Brown the moon has made her regular rounds on time, but the astronomers have been to blame for the discrepancies because their clocks have not kept correct time. Their clocks, like all time pieces, are set by the length of the day and this is determined by the rotation of the earth, which is assumed to be unvarying. But the speaker pointed out that if the earth swells and shrinks from five inches to twelve feet in a period of years it would account for failure of the calculated path of the moon to agree with her actual movements. Such a rising and falling of the earth's crust might be due to the same causes as produce earthquakes, mountain-building and similar disturbances.

ANOTHER failure to make artificial gold was reported. Professor W. D. Harkins, of the University of Chicago, has been bombarding mercury with streams of electrons from an X-ray tube at 140,000 volts. If any one of these particles of negative electricity should become embedded in the nucleus of an atom of mercury, this would be transformed into an atom of gold. No trace of gold was found after long bombardment although the test was delicate enough to detect one part of gold in a million of mercury. Professor Miethe, of Berlin, and Professor Nagaoka, of Tokyo, claim to have made gold from mercury by a similar method but no American chemist has confirmed their result. But that the transmutation of other elements is possible was demonstrated by Professor Harkins who showed photographs of the collision of the nucleus of a helium atom, traveling twelve thousand miles an hour, with a nitrogen atom. A fluorine atom is probably first formed but this breaks down instantly into an oxygen atom.

FEMINISM scores another point in the demonstration that the female sex is superior in chemical activity. The demonstration is visible to every visitor to the exhibition rooms of the National Academy of Sciences in the form of a series of test tubes containing colored liquids, in which the feminine sample shows up stronger than the masculine. The test, which was invented by a Russian investigator, Manilov, can be applied to plants as well as animals and a few drops of blood or sap is sufficient, showing that sexuality pervades the entire living organism. In experiments carried on by A. F. Blakeslee and Sophia Satina at the Station for Experimental Evolution as part of Research on Sex Problems of the National Research Council, it has been found possible to get the sex directly more than nine times out of ten by the Manilov test. It was explained that the test could be used to determine the sex of the fungi of bread molds, which are so simple and similar in structure that it has never hitherto been possible to tell which was male and female.

A DIET that will accelerate growth most amazingly has been worked out by Thomas B. Osborne and Lafayette B. Mendel, of New Haven. White rats used for experiments in dietetics for a dozen years have been bred from the same stock, and they have shown a noticeable increase in the rate of growth. In 1912 a male rat required on the average 94 days to reach full weight, while in 1925

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the time had been reduced to 67 days. This gain in growth came about unconsciously through the continuous selection of the more vigorous animals. But now the experimenters have found it possible to reduce the growing period to less than 25 days by putting the young rats on a special diet. This ration contains an unusually liberal allowance of protein and a variety of such food materials as lettuce, liver and yeast. These experiments point to the possibility of speeding up the growing process in animals by the double method of developing the hereditary tendency through eugenics and of furnishing such food as will stimulate rapid development. Whether such a forcing process has any deleterious effects on the individual or his progeny remains to be determined. If it would affect children the same as rats, we may expect to see six-footers of six years old. This reminds one of the fantastic romance of H. G. Wells, "The Food of the Gods."

BOTANISTS used to be content to collect and classify what plants they could find, but now they are experimenting on the production of new forms of growth. Dr. Erwin F. Smith, of the U. S. Department of Agriculture, has found that he can get strange shapes of sunflowers by inoculating the young flower beads with crowngall bacteria, or by simply pricking them with a needle. This irritation of the growing tissue may produce such abnormalities as ray flowers in the wrong places, rootlets where flowers should be, and cavities lined with hairs in the pith of the plant. The formation of such cysts reminds one of cancer growths, which likewise may be caused in some cases by local irritation of the skin and spread through the system.

THE chemistry of cat fright was explained by Dr. W. B. Cannon, of Harvard University. What sets the cat's heart to beating when a dog barks at her is an increased secretion of the adrenal glands. When a cat that has been lying down gets on its feet her pulse increases ten or fifteen beats a minute. Hearing the bark of a dog raises the pulse rate twenty. But when the cat gets thoroughly frightened or fighting mad, the heart is accelerated by seventy or eighty beats. The excitement may not die down for twenty minutes. The hair raising, the ear lowering, the hissing and the snarling are but the outward and visible signs of an inward and chemical change in the composition of the blood, namely an increase in the percentage of adrenin. As small an amount as one part in a million of this chemical compound will perceptibly stimulate the circulation of a denervated heart.

THE management of mobilization during the late war was sharply criticized by Dr. Victor C. Vaughan. Dr. Vaughan was for thirty years the head of the Medical School of the University of Michigan and is an authority on the cause and prevention of epidemics. He pointed out that "The procedure followed in the mobilization of our soldiers brought into every cantonment every infection then existent in the areas from which the men came. Each one brought samples of the bacteria then abounding in his own neighborhood." Every troop train coming into Camp Wheeler, Macon, Georgia, in 1917, brought cases of measles in the eruptive stage. All susceptible individuals came down practically on the same day or two, thus overwhelming the hospital facilities and predisposing to pneumonia. Twelve times as many young men died of pneumonia in the camps as would normally be expected in a civilian group of the same sort. Cerebrospinal meningitis was brought from places where it was known to be endemic and spread in Camp Funston, Kansas, and Camp Jackson, South Carolina. When the military authorities were warned of what would happen they replied: "The purpose of mobilization is to convert civilians into trained soldiers as quickly as possible and not to make a demonstration in preventive medicine." Dr. Vaughan adds: "The most insane procedure carried out in 1918, from the viewpoint of an epidemiologist, was the sudden and complete mobilization of the students in our universities in the Students' Training Corps. How many lives this procedure sacrificed I can not estimate."

"CALCIUM, when utilized, is pep," was the slogan of Dr. Weston A. Price, of Cleveland. He showed photographs of chickens suffering from Cleveland smoke which shut off the sunshine which facilitates the assimilation of lime in the blood and bones. In case of a shortage of sunshine its place may be supplied by doses of cod liver oil, which is especially active if it has been exposed to the direct rays of the sun for half an hour. The activating factor in light is the ultra-violet rays. These have too short a wave length to be visible or to pass through glass, so no glass must intervene when the chickens, children or oils are exposed to sunlight. Dr. Price finds that merely rubbing the activated olive oil on the neck of a chicken will raise the calcium content of the blood and improve the physical condition. There is no calcium in the oil, but somehow such of the oil as was absorbed brought more blood into the circulation from the food. The same treatment has proved beneficial to humans. Rubbing raw or activated cod liver oil on inflamed joints is reported to have improved conditions in cases of lime deficiency. In babies such deficiency shows itself in the weak and bended bones of rickets, in children and expectant mothers in rapidly decaying teeth. Such cases have been improved by the administration of calcium lactate to supply the lime, and cod liver oil or sunbaths, to promote its assimilation. The old rule for mothers of "a tooth for every child" need no longer hold.

THE AMERICAN GEOPHYSICAL UNION

THAT the waters of the ocean, and the air around the earth, came out of the rocks, is the idea suggested to the American Geophysical Union, in session at Washington on April 30, by Dr. W. J. Humphreys, of the U. S. Weather Bureau. Dr. Humphreys bases his suggestion on the theory, now widely held, that the earth was originally part of the sun and that it was pulled out of it by the passage of a larger star close by, due to gravitational attraction. In this case, he says, the hydrogen, nitrogen and oxygen to form the ocean and the atmosphere of the earth were pulled from the outer layer of the sun, as

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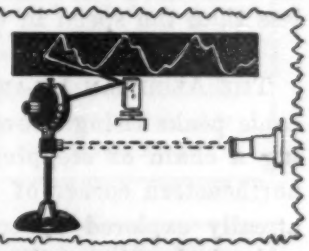

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well as the heavier elements. "Presumably," he says, "most of the mass of the earth collected into a liquid nucleus great enough to retain by gravity all the elements of the air, including water vapor, except hydrogen and helium. In a comparatively short time this nucleus cooled sufficiently to form a more or less stable crust, after which it soon became cool enough to permit the greater part of the water vapor, if it existed in large quantity, to condense. At this lower temperature the earth could also retain both hydrogen and helium. The thickening of the crust must have been accompanied with innumerable eruptions and lava flows, all giving off then, as they do to-day, water vapor, hydrogen, nitrogen, oxygen and carbon dioxide, previously absorbed by the rocky material when liquid or gaseous. In this way the primordial water vapor and the fixed gases of the air, however great or small in amount, were supplemented from within the earth until an atmosphere substantially as now exists was formed, and the oceans covered most of the earth."

THE center of the earth is composed of very heavy materials, possibly metallic iron, Dr. Paul R. Heyl, of the U. S. Bureau of Standards, told the American Geophysical Union. He bases his conclusions upon determinations which he has been making of the density of the earth, which he finds to be about five and a half times that of water. As the average density of the rocks in the earth's crust is only two and a half times that of water, the center must be of much greater density. This view was supported by the statements of Robert B. Sosman, of the Geophysical Laboratory of the Carnegie Institution of Washington. Mr. Sosman has studied the passage of waves from earthquakes through the earth. These studies have established with reasonable certainty, he said, "that the earth is a solid object without any very extensive liquid layers within it. It contains a core about 2,200 miles in radius. This core reflects and refracts as if it had a clearly marked surface, and is capable of transmitting elastic waves, but at a speed which is much less than the speed in the overlying material."

THE ALEUTIAN ISLANDS, a string of thirty or more volcanic peaks rising above the surface of the sea and forming a chain of stepping stones between Alaska and the northeastern corner of Siberia, are at last to be systematically explored by scientists. Hitherto they have remained almost as unknown as they were when the United States purchased Alaska from Russia, but at the annual meeting of the American Geophysical Union preliminary steps were decided upon that are expected to unlock their secrets. Many scientific agencies are interested in the Aleutians: the U. S. Geological Survey and the Geophysical Laboratory of the Carnegie Institution of Washington in the volcanoes; the U. S. Department of Agriculture in climate, soils, forests and wild animals; the Coast and Geodetic Survey in the accurate charting and mapping of the land and water areas; the Army and Navy in their relation to the national defense. These and other institutions expect to cooperate for a considerable number of years to come in obtaining and making available accurate information about this little-known territory.

ITEMS

THE number and behavior of the white blood cells are now studied to detect the presence of contagious diseases in their early stages. The white cells, or leucocytes, are the body's natural means of protection against the toxins of disease and infection. For that reason elementary physiologies used to call them "soldier cells." Dr. C. H. Bunting and E. Thewlis give an account in a forthcoming number of *The Archives of Pathology* of the observations they have made at the student infirmary at the University of Wisconsin in studying the blood counts of students suffering from smallpox and several of the childish diseases. They have found that there is a general similarity in the behavior of the leucocytes in measles, mumps, chicken pox and smallpox. There is a decided falling off in the number produced at first with a gradual return to normal, followed in the case of smallpox by a marked increase which lasts during the active stage of the disease. Scarlet fever varies from the others by displaying an abnormally large number at the very beginning.

DAIRY cows can live and thrive without vitamin C in their ration, according to Professors L. M. Thurston, C. H. Eckles and L. S. Palmer, of the University of Minnesota. It is definitely known that man requires a certain amount of a substance known as vitamin C or the anti-scorbutic vitamin; and unless the required amount is supplied by food the disease known as scurvy develops. This same fact is known to apply to certain animals also, among which are the guinea pig and the monkey. Two outbreaks of a scurvy-like disease among cattle have been reported, one from England and one from Australia, apparently caused by faulty nutrition. Since this disease had all the symptoms of scurvy which is due to a lack of vitamin C in the diet, experiments were made to determine the rôle of this vitamin in the nutrition of cattle. Two calves were fed on a diet extremely deficient in vitamin C for a period of 350 days. With the exception of this vitamin deficiency the diet was well balanced and varied. The animals grew normally in every respect and showed no symptoms of scurvy. Guinea pigs on the same ration die of scurvy in thirty days.

"HOT soap suds and water," the good old-fashioned remedy for all cleansing purposes, has real germicidal properties, according to experiments carried on at the Army and Navy General Hospital at Hot Springs, Ark., by Dr. J. E. Walker. In a forthcoming issue of *The Journal of Infectious Diseases*, Dr. Walker says that any ordinary soap used with a reasonable degree of care will kill several kinds of bacteria, notably those that cause pneumonia, gonorrhea, diphtheria and several of the pus-forming organisms. The dysentery and typhoid bacilli die harder. Strong soaps made of what is known as saturated fatty acids are necessary to annihilate these tough ones. A salt-water soap, prepared exclusively from coconut oil, is the most readily available efficient soap to rid the hands of possible typhoid bacilli. Unfortunately an all round coconut-oil soap is too irritating to the skin for ordinary use.

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SCIENCE NEWS

Science Service, Washington, D. C.

WORLD NITRATE SUPPLIES

DR. F. G. COTTRELL, director of the Fixed Nitrogen Research Laboratory of the U. S. Department of Agriculture, reports to Science Service by radio from Biarritz, France, that nitrates manufactured out of the air, which a decade ago were an intensely national concern of importance chiefly in the destructive business of war, are now an international concern of basic importance to agriculture, being discussed at Biarritz by nations only a few years ago at war with each other. America, Belgium, France, Germany, Great Britain, Holland, Italy, Java, Norway and Sweden, at once the chief producers and the largest consumers of artificial nitrates, are represented here by scientists and economists whose hope and ambition is mutual cooperation in the capture of more and more of the vast, scarcely tapped mines of nitrogen in the air all about us, to be chemically fixed and eventually turned into food for the increasing millions of the earth's population.

Through improved methods in nitrogen fixation and a stabilization of marketing, continuing decreases in fertilizer costs to farmers are in plain prospect.

Of perhaps even greater importance are the contributions of botanists interested in agriculture. Not contented with merely renewing the natural nitrate supplies in the soil, the agricultural scientists are undertaking programs of "forced feeding" of plants, comparable with the fattening-up processes used in preparing animals for the market. Plant physiologists have recently learned that properly calculated overdoses of nitrates will induce plants to produce fruits or heads of grain earlier and in larger quantity than normal. Geneticists are at work in an endeavor to breed new strains that can take up even greater amounts of nitrates than the ordinary breeds of plants now under cultivation are able to use. Professors Erwin Baur and Herman Warmbold, of Berlin, and the great Swedish plant breeder Hermann Nilsson-Ehle, stated that a program of several years' experiments could make such "nitrogen-greedy" plant varieties a distinct possibility; and Dr. Karl Bosch, of Berlin, and Ferdinand Speyer, of London, stated that the nitrogen industry is planning to spend millions on such research.

Agricultural education in the most advantageous methods of nitrate use has also come in for its share of attention. Especial stress was laid on the desirability of improved methods of distribution of concentrated nitrate fertilizers in regions where transportation facilities are poor, notably in the tropics and in India and China. Improvements in agricultural conditions made possible by the use of cheaper concentrates in regions now periodically threatened with famine are expected to go far to avert these calamities, which in the past have not only been a scourge to the afflicted populations but a cause of social and economic disturbances throughout the world.

THE BRITISH FOOD SUPPLY

WHAT is the state of the English cupboard? This question, which was so important during the world war when German submarines threatened to cut Great Britain off from the outside world, is being asked again as the industrial strike continues, and estimates made in America are as likely to be reliable as what is coming now by cable.

The war emergency brought out surveys and investigations of the entire British food question, and efforts were made to encourage home production of grains and other foods. But the present situation finds England with a food supply on hand that is a little below the normal stock for normal times when shipments are steadily coming in.

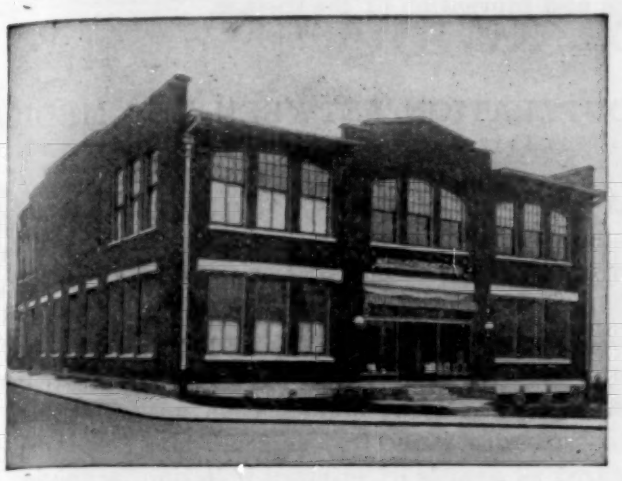
Imports of wheat and flour are lower this year than at similar periods last year. April figures show that the wheat supply at British ports is 4,000,000 bushels less than last year. And how much of the 7,720,000 bushels of wheat at the ports will be turned into flour by the mills during the strike is uncertain. Home-grown wheat provides only one fifth of Great Britain's needed supply of this important item of food.

Stocks of bacon at Liverpool during March of this year were lower than last and stocks of ham amounted to only a little over one fourth of the stock held at the same time last year. Beef imports are a little higher than last year and mutton a little lower. The great bulk of the milk supply is home-produced and special efforts are being made to distribute it as it is the most vital article of food for young children.

The British people will be better off when it comes to fruit and vegetables, in the opinion of Edwin Smith, assistant chief marketing specialist in the U. S. Bureau of Agricultural Economics, who has just returned from London. There will be no acute shortage of potatoes, on which the British housewife relies so heavily, and while this is not a season for large stocks of home-grown vegetables, the southern markets have been regularly sending shiploads of spring produce to British ports.

"This is the peak of the season for Australian and New Zealand apples to reach England," said Mr. Smith. "Whether the cargoes will be unloaded, however, is another question. It is likely that commission merchants will use their own trucks to handle the fruit and get it from the docks to market. Cabbage and cauliflower have been coming in from France and Italy and new potatoes from North Africa, and these cargoes face the same situation at the docks. Undoubtedly the commission merchants and the farmers will be able to transport quantities of vegetables and fruit on lorries."

Mr. Smith points out that while the British population has continued to increase, land under cultivation in the United Kingdom has decreased. It was asserted during the world war that the country might conceivably make itself independent of other nations for its food supply, but to do this it would have to abandon or greatly diminish many of its most important manufacturing industries. The present emergency can not be met by plans for increasing future harvests, but it may again stimulate interest in farming among the British people.



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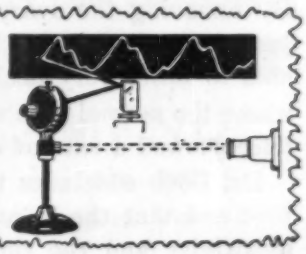

THE CAUSES OF CANCER

CANCER is caused by the related operation of several factors, rather than by a single cause. This is the conclusion reached by Dr. Leo Loeb, of Washington University, after many years of research on breast cancer in mice.

Since 1910 Dr. Loeb has been collaborating with Miss A. C. E. Lathrop, of Granby, Mass, on inbred strains of mice in order to determine what effect family predisposition has on the incidence of spontaneous cancer. Recently, Dr. Loeb's results have been verified by Dr. C. F. Cori, of the Institute of Malignant Diseases in Buffalo.

Briefly, Dr. Loeb believes that hereditary disposition, in the case of mammary cancer in mice, plays a very important rôle in the spontaneous development of the disease, but that heredity alone is not decisive. The presence of certain internal secretions is essential to supplement or cooperate with the animal's innate sensitivity. When these secretions are withheld, the animals do not so readily develop the disease—a discovery that may have important practical bearing on efforts to prevent cancer or at least to lower the cancer rate among human beings.

In dealing with the causes of cancer, the problem always narrows down to the question, what makes this particular group of cells *grow* so outrageously. Various causes have been and are continually being suggested to account for this misplaced energy, from microorganisms to the psychic condition of "worry." It is known that continued irritation of a mechanical or chemical sort can induce cancer, but the spontaneous development of the disease, the sudden rush of energy, the "will to grow," on the part of a particular group of cells, for no visible reason, is baffling.

Dr. Loeb established the fact that among mice inbreeding of different strains produces families with distinctly different degrees of susceptibility to cancer of the mammary gland, which is the most common form of cancer among mice. He felt convinced, therefore, that heredity plays an important rôle in the spontaneous appearance of cancer among mice and, in all probability, that it also plays an important rôle in cancer incidence among human beings although the usual statistical methods fail to reveal the importance of heredity. Dr. Loeb found that some mice families showed as high as 60 or 70 per cent. cancer rate while others showed only 4 or 5 per cent. or even less. He found, however, that the hereditary influence could be checked in female mice by cutting off the supply of internal secretion from the ovary. The normal growth of the mammary gland is dependent upon the hormone from the ovary and similarly the excessive, abnormal growth of cancerous tissue in the mammary gland is influenced by the ovary secretions. By removing the ovary at the age of six months or less, just after the mouse is sexually mature, Dr. Loeb was able to lower very decidedly the cancer rate. In strains where the normal rate was 60 to 70 per cent, the castrated mice showed a rate of only 11 per cent.

Dr. Loeb concludes that the causes of cancer are complex and that the balance of different factors, hereditary sensitivity and the supply of internal secretions, beside whatever external stimuli may be applied, must be studied quantitatively in order to give greater insight into the cause and prevention of the disease.

COOPERATION BETWEEN THE MEDICAL AND DENTAL PROFESSIONS

AT a meeting of the Maryland State Dental Associati Dr. Lewellys F. Barker, of the Johns Hopkins Hospit recently urged closer cooperation between the dental a medical professions is necessary to ascertain just how f mouth infections are responsible for disturbances to t general bodily health. Neuritis, several varieties rheumatism, nephritis, inflammation of the eye and s ondary anemias were cited as conditions that frequent appeared as sequels of primary infection in another pa of the body.

Dr. Barker considers that there has been a great de of over-emphasis upon the importance of such focal i fections and he scores heavily the present-day tende toward the wholesale removal of teeth without we grounded justification. It is particularly difficult to rea a conclusion in such cases because the infections of t mouth region are a secondary cause of the accompanyi disturbances unlike the diseases where a specific organi is the culprit. There has in consequence been much dou and speculation and considerable experimentation. T is the reason, according to Dr. Barker, why this field h been so accessible to over-enthusiastic, insufficiently e perienced practitioners.

To keep the middle path of sanity between faddi diagnosis and culpable failure of recognition of imp tant disease processes is difficult but necessary to eve member of either profession. If the public is to reap t fruits of the knowledge that actually exists in regard the relation of mouth infections to other bodily distu ances, the leaders in both branches must exert to the most their protective influence against the practices certain members of their respective professions.

In the present state of knowledge of the whole subj it is very difficult to decide conclusively when a to should be removed and when it should be retained. B professions should be very cautious to avoid premat application of findings that are not supported by sou observation and experimental evidence.

Dr. Barker concludes with a decided rap at what calls pseudo-research in medicine and its special branc including dentistry. The general haste to rush into pr with results that are not sound is harmful to both t public and the less well-informed practitioners. The tellect and imagination of the research worker should of high order, and the work should be under the direct of experienced investigators. The mistakes of work conducted will be fewer and less serious than those workers of less ability and experience. The face of medical professions generally should be set agai pseudo-research that is irresponsibly undertaken and inaccurately conducted. It is a degradation to scie and misleading to the public that the true scientist t to serve.

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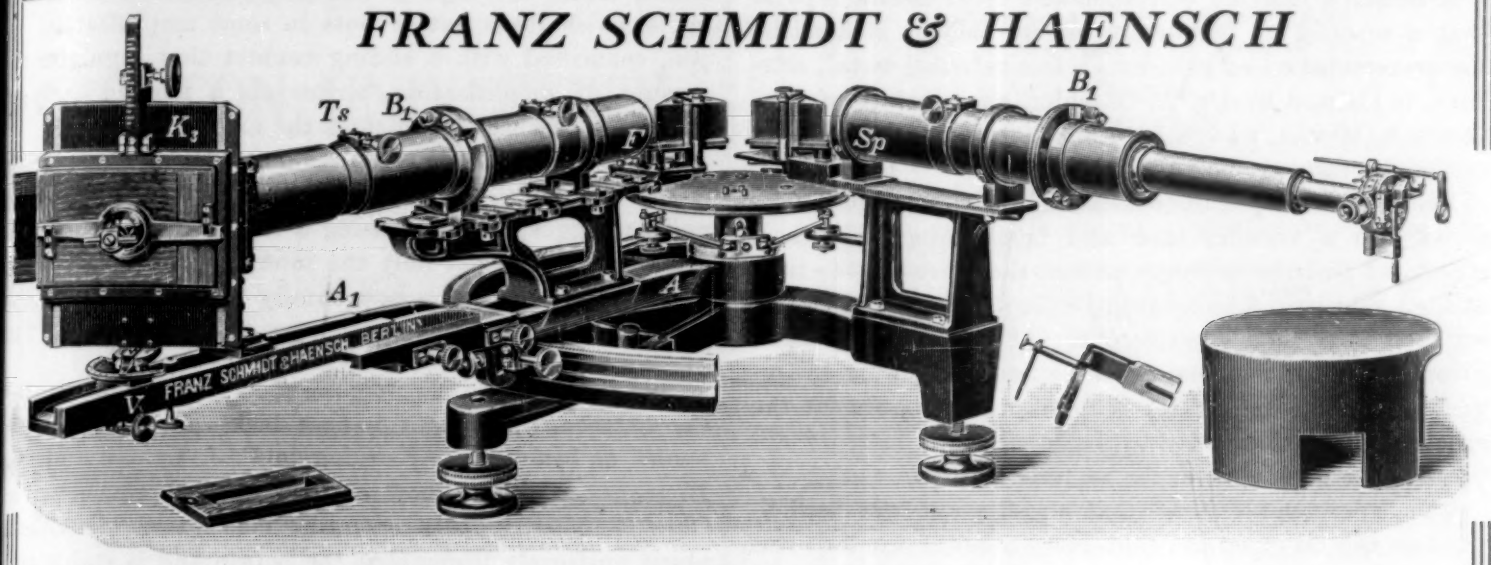

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THE ALLEGED TRANSMUTATION OF GOLD

A SCIENCE SERVICE correspondent from Berlin reports that a reversal of the dream of the ancient alchemists, the transmutation of gold into a less valuable metal, mercury, is claimed by Dr. A. Gaschler, an associate of Professor A. Miethe, who in 1924 announced that he had succeeded in turning mercury into gold.

Dr. Gaschler's process consisted in sealing a gold electrode into a vacuum tube and bombarding it with a stream of positive hydrogen atoms, shot through the tube at high velocity. The resulting color display Dr. Gaschler watched through a spectroscope. At first the only light given off was of the color characteristic of glowing hydrogen, but at the end of thirty hours of bombardment the spectrum lines that indicate the presence of mercury appeared and became stronger as time elapsed.

The experimenter states that an oil pump was used to produce the vacuum, and that every other precaution was taken to prevent the contamination of either the gold electrode or the hydrogen gas with mercury. He is confident that he has actually produced mercury from gold.

Dr. Gaschler calls attention to the similarity of his work to that of a British physicist, J. J. Manley, who succeeded in inducing helium to form a chemical union with mercury by bombarding mercury with a stream of helium atoms. Helium had long been known as one of the most inert of the elements, never forming compounds with any of the others.

He is of the opinion that if his results are confirmed upon further repetitions and refinements, they will lend support to Dr. Miethe and Dr. Hantaro Nagaoka, whose claims that they changed mercury into gold have been subjected lately to skeptical criticism.

AN INSTRUMENT TO RECORD THE INTENSITY OF STATIC

MOST radio fans are not sufficiently fond of static to want to keep a careful record of it, but since the intelligibility of a radio signal in a receiving set is determined by the ratio of the strength of the signal to the intensity of static, radio engineers want to know its ups and downs.

In a new instrument devised by H. T. Friis, an engineer in the Bell Telephone Laboratories, the static is made to write its own record.

Instead of measuring directly the amount of static, Mr. Friis uses a specially constructed receiving set in which the output, due to the static, is kept constant. This is done by an amplifying system which increases or decreases the amplification according to the weakness or strength of the static. Such a system is necessary, rather than a constant amount of amplification with measurement of the output, because the static varies so greatly in strength. According to Mr. Friis, the change is generally as much as from one to a hundred in a day and sometimes from one to ten thousand, so that with constant amplification it would be difficult to avoid overloading the tubes.

A fluxmeter, an instrument to measure the quantity of electricity, is connected with the receiving set in place of a loud speaker. When the pointer goes past certain limits, either too high or too low, an electric contact is made which takes out or puts in some amplification. A pen, connected with a sliding contact that regulates the amount of amplification, writes on a moving strip of paper the line which indicates the amount of static.

Mr. Friis states that the invention of the instrument is too recent to have yet given any comprehensive data, and he suggests that by using a slowly rotating loop antenna in the set, not only the intensity but the direction of the static may be automatically recorded.

ITEMS

THE lowly spud is an important source of vitamin B—the antineuritic vitamin, whose lack causes the disease known as beri-beri. According to F. J. Lyman and Inez Blystone, of the Laboratory of Applied Chemistry at Ohio University, this essential element is distributed about uniformly throughout the potato and is stable both during cooking and storage. Measured in calories, the white potato furnishes about twelve per cent. of the American dietary. Mr. Lyman and Miss Blystone have conducted a series of experiments in which they have found that rats thrived and grew at a normal rate on a diet containing as much as eighty per cent. potatoes. When put on a diet of only forty per cent. potatoes from which other foods containing vitamin B were excluded, the rats showed a rapid decline in condition which disappeared as soon as a sufficient quantity of vitamin B was again supplied.

HYDROCYANIC acid, one of the most poisonous insecticides in use, can now be prepared in a stable powdered form. Since this efficacious bug-killer has previously been available for trade purposes only in solutions that decompose in concentrations of any very great strength, the powdered form is regarded as a highly desirable improvement. F. C. Metzger, in a report of his process for the production of this form of hydrocyanic acid to *Industrial and Engineering Chemistry*, says that the powder lends itself to all sorts of fumigating where dusting apparatus can be used. Dusting has likewise proved a most effective and penetrating method of treating fruit trees for various pests, and has to a certain extent replaced spraying. Kept in air-tight containers, powdered hydrocyanic acid remains stable at all ordinary temperatures, decomposing only on contact with moisture.

IN experiments at the Geophysical Laboratory of the Carnegie Institution of Washington that simulate the conditions of extremely high temperature and pressure of the earth's interior, Dr. Leason H. Adams and Dr. Ralph E. Gibson have found that rocks have much more elasticity than was formerly supposed. In a report to the National Academy of Sciences Dr. Adams said that they had found that the least silicious of the silicate rocks, known in geological parlance as Dunite, when subjected to very high pressures was three fourths as rigid as steel. The calculations of the two experimenters have been found to tally with seismological data which definitely establishes that the main part of the earth consists of periodite rock or the stuff that meteors are made of.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE TRANSMUTATION OF GOLD

GOLD from mercury—was it really made by Professor A. Miethe in his electric tube?

This question, which has been agitating the scientific world for the past two years, was discussed at the recent meeting in Berlin of the German Chemical Society.

The opponents of the claims of Professor A. Miethe and Dr. Hantaro Nagaoka, who independently worked out the process by which they claim to have produced gold from a baser metal, massed an attack against the German and Japanese scientists, and were met by the stout defense of their supporters.

Professor E. Riensenfeld, of the University of Berlin, believes that distillation of mercury to absolute purity was impossible and that there would always be traces of gold present to vitiate the results of the experiment. Professor E. Tiede, also of Berlin, presented a flat counter-claim, stating that he had obtained pure mercury, gold-free, without difficulty; but he added that when he repeated Professor Miethe's experiment the results were wholly negative.

Professor Fritz Haber, famous for his contribution to the solution of the fixed-nitrogen problem, outlined the extreme difficulty of obtaining absolutely pure mercury, and of keeping it pure throughout the long course of an experiment. The presence of gold even at a distance, as in the operator's spectacle-frames or in metal compounds in an adjoining room, might spoil the experiment through being drawn in ultramicroscopic quantities into the electric current, by an effect like that of the cathode rays.

Professor E. Duhme stated that mercury always contains traces of gold, but that these may not be capable of detection, except after considerable ageing of the mercury by standing, or even by being subjected to an electric current.

Professor Miethe in an interview with a representative of *Science Service* stated he sees no present reason for changing his views. The process really active in changing mercury into gold, he said, is still unknown, and consequently success in a repetition of his experiments is possible only by chance. He intends to publish his work in full at an early date, and in the meantime he will exchange his apparatus with other experimenters, to eliminate possible sources of errors due to differences in construction.

Professor Miethe stated that in forty-two experiments the output of gold was constantly proportional to the amperage of the current and to the time of the process. When repeated with all conditions identical, but without turning on the current, the result was negative.

The purification of mercury for the experiment is a very difficult distillation, probably involving a complicated atomic process not yet well understood. Much further research on this detail alone is needed, according to Professor Miethe. He stressed also the dangers involved by the extremely poisonous nature of the mercury vapors.

THE MEASUREMENT OF LONGITUDE

A FREELY swinging pendulum, not connected with any clockwork, will probably be used as a timepiece to measure longitude next fall when the United States cooperates in a world-girdling longitude survey, according to Edwin J. Brown, of the U. S. Coast and Geodetic Survey, who spoke before the recent meeting at Washington of the American Geophysical Union. The ordinary chronometer, used in most such observations, is not accurate enough for this purpose, and Major William Bowie, of the survey, suggested the use of the pendulum, which is ordinarily used in determinations of the intensity of gravity.

The determination of a difference in longitude is the measure of the difference in time between two points, the longitude of one of the points being known. The modern method of making the determination is to find the time at the unknown point by star observations and compare it with a time signal sent by radio from the point of known longitude.

The accuracy obtained is dependent upon the quality of the timepiece used to carry the time from the epoch of the star observations to the time of reception of the radio signals. An ordinary ship's chronometer is fairly satisfactory if the time signals can be received during the star observations, but if it becomes necessary to carry time for several hours, as will be the case on the world longitude work, a more accurate timepiece is needed.

The period of oscillation of the gravity pendulum can be determined to the nearest millionth of a second and in carrying time over a three-hour period the error due to the pendulum would be of the order of 0.002 or 0.003 seconds. A chronometer may show an error of 0.05 seconds or more over a three-hour period.

How the same sort of pendulum is used in making gravity determinations at sea was described by C. H. Swick, also of the Coast and Geodetic Survey. The ordinary type of pendulum can not be used on a boat, because of the rolling and pitching, but in 1923 the Dutch Geodetic Commission, with the cooperation of the Dutch Navy, tried the experiment of swinging pendulums on a submerged submarine and recording the oscillations photographically. The submarine was found to have an appreciable roll and pitch, even when submerged 75 feet below the surface, but the effect was eliminated from the results by swinging four pendulums at the same time and combining the records of the individual pendulums.

The method was devised by Dr. F. A. Vening Meinesz, engineer to the Dutch Geodetic Commission.

ACTION CURRENT FROM A SINGLE-NERVE FIBER

THE electric current that shoots along a nerve fiber has been detected by means of radio apparatus, according to Dr. E. D. Adrian, of Cambridge University, who described before a meeting of the Physiological Society

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his method of using a three-tube instrument to make his delicate measurements.

It had long been known, he said, that the passing of messages down a nerve caused an electrical disturbance. But it had only been possible to record the effects from a large number of fibers at once, for example, the thousands of fibers from an eye, or to a muscle. The results obtained were therefore as confused as would be the superimposed records from all the telegraph wires between London and Manchester. Dr. Adrian's new apparatus makes it possible for the first time to obtain records in a rapidly moving photographic plate of the impulses passing along a single fiber.

In conjunction with Dr. Zottermann, a Norwegian neurologist, Dr. Adrian recorded the results of stimulating a sense organ connected to the brain by a single fiber. The sense organs in the skin which give information as to touch, pain and temperature, are too near together for this to be easy. Those in the muscles subserving the so-called muscular sense are farther apart, and by stretching a frog's muscle, it was found possible to stimulate a single one. The impulses were all of the same size, but as the muscle was stretched, their frequency was increased from ten to fifty per second. Differences of intensity are in fact transmitted through the nerves as differences of rhythm.

This is the first occasion on which the message passing along a nerve has been decoded, and the experiment opens up a new field of neurology, in the opinion of physiologists. Within the next few years it should be possible to read the main types of messages entering and leaving the nervous system, and the time has been brought measurably nearer when it will be possible to record the actual events in the brain which are the physical correlate of consciousness.

GLAND TRANSPLANTATION

Two physicians of Florence have performed an operation which bolsters up the failing hope that gland grafting had put a new weapon in the hands of the medical profession for subduing hitherto unconquerable disease.

Drs. Cesare Frugoni and Vittorio Scimone have announced, through the *Presse Medicale*, the results of treating a case of tetany, a chronic disease resembling lockjaw, with a graft of human parathyroid, one of the small glands placed around the better known thyroid in the neck. The technique followed was that of Dr. Serge Voronoff, one of the original experimenters in transferring glands from apes to humans.

The results were almost instantaneous, according to the authors. The patient, released from the terrific pain suffered during six or seven long attacks every day, picked up amazingly. Tests made some time later still showed a slight parathyroid deficiency, but the ingrafted piece was still firmly attached under the skin five months after the operation.

The question of greatest concern to physicians with respect to the case is how long the gland will persist, for the laws that govern a graft's chance of survival comprise one of the subjects on which the medical profession is still in the dark.

Editorial comment apropos this aspect in the *Lancet* says: "Much of the interest of the case depends on how long the graft will survive, but it has served to prove the connection between chronic tetany and parathyroid deficiency and to demonstrate the advantage of Voronoff's innovation. Even if the hopes of the authors are destroyed by the ultimate disappearance of this, as of most grafts, they have at any rate made a substantial contribution to the resources of gland therapy."

RECENTLY DISCOVERED VOLCANOES

THREE more volcanoes have been added to the map of American territory, and two of the new craters rank with the giants among the fire-mountains of the world. How he explored these hitherto unknown mountains was told before the recent meeting of the Washington Chapter of the Society of the Sigma Xi by R. H. Sargent, topographic engineer of the U. S. Geological Survey.

The newly mapped volcanoes lie in the Aleutian Peninsula, the long tongue that juts out from the mainland of Alaska, between the Behring Sea and the Pacific Ocean. This strip of land, which contains more active and extinct volcanoes than all the rest of North America, has as yet been very little explored.

The first of the volcanoes mapped by Mr. Sargent was a peak that had been known at a distance for some years, but it had not been learned that it was a volcano. The Geological Survey party traveled by pack-train entirely around the base, a total distance of one hundred miles, mapping the slopes as they went. They ascended to the rim, the highest point of which has an altitude of 4,200 feet, and investigated the immense crater, six and a quarter miles in diameter. The volcano is apparently quite extinct, for at the bottom, in addition to one large secondary cone and several smaller ones, is a lake of considerable size. The waters of this lake break through a gap in the wall of the mountain and form the Aniakchak River, from which the mountain has been named Aniakchak Crater.

The second volcano discovered by Mr. Sargent lies to the west of Aniakchak Crater, and was named Purple Crater because of its peculiar color. It is the smallest volcano of the three, and is of interest chiefly for a great central mass or plug of basalt that chokes it up.

The third mountain is another giant, 6,000 feet high, with a crater five miles across. It shows signs of having been active in recent times, and a record dated 1892 states that a distant and then unvisited peak, which apparently is the same mountain, was seen smoking. If it should stage a really major eruption it would probably be a terrific one, for the whole vast bowl is filled with a mass of ice and snow, through which a black secondary cone projects at one place. This frozen sea inside the crater feeds at least nine large glaciers that creep down the sides of the mountain. The Russians had seen this mountain at a distance and had given it the name of Weniaminoff, which will probably be retained on the new maps.

Mr. Sargent stated that any one who likes to rough it in unexplored country, even if not interested in geology or any other science, would find the mountains of the Aleutian Peninsula a happy hunting ground. "It is

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relatively easy to get into,'' he said, ''and fairly swarms with game. We saw fifty-two big brown bears and caribou innumerable, and the streams are alive with fish.''

PREHISTORIC FOOTPRINTS FROM THE GRAND CANYON

NEW finds of footprints of reptiles left in soft sand at least 25,000,000 years ago have just been made in sandstone 1,800 feet down from the rim of the Grand Canyon. This is the greatest depth in the canyon at which such prints have been found.

The prehistoric tracks were found by Charles W. Gilmore, curator of vertebrate paleontology of the National Museum, and will be added to the government's fine collection of footprints of the Permian Age. Mr. Gilmore, who recently returned to Washington, spent three weeks in Arizona, and obtained from the canyon a ton and a half of material containing fossil tracks of reptiles and prints of plants.

These ancient prints can be used as evidence to assist geologists in determining more exactly the age of the beds of rock in which they were found.

The fact that the prints were found 1,800 feet from the top of the canyon means that after these queer, long extinct reptiles impressed their feet in what was then moist sand, almost 2,000 feet of rock material was slowly piled up in successive strata above the prints. And this does not take into account many additional hundreds of feet of material that have been eroded off from the present top of the canyon wall. So the length of time required for the deep canyon to form was obviously stupendous.

The level at which the fossil plants and reptiles have been found belongs to the later part of the carboniferous period, or the time when the great coal beds of the world were being formed, and was a few million years before the famous reign of the dinosaurs.

One specimen brought back by Mr. Gilmore shows a row of tracks very much like mouse tracks impressed in a small slab of red stone, and in among the tiny footprints is a wavy line which represents the track of the animal's tail. Other exhibits show prints larger than a man's hand, indicating that some of the reptilian creatures of this age may have become as large as crocodiles. No bones of these creatures have been found in the Grand Canyon, though some bones of reptiles making similar tracks have been found elsewhere.

The plant specimens have not yet been studied by a museum specialist, but some of them are fern-like plants, the prints of which are several feet tall.

WEIGHTS AND MEASURES

SHOULD ice-cream be sold by the pound or by the quart? What is the best place on a taxicab for a taximeter? These are two of the subjects that will be brought up, and probably settled, when weights and measures experts from all over the United States gather at Washington on May 25 to 28.

The meeting, known as the National Conference on Weights and Measures, will consider a number of questions which are of direct importance to the consumer.

Advisability of selling eggs, fruit and vegetables by weight instead of by measure or by count will be discussed. Massachusetts and New Jersey have recently adopted the plan of having dry commodities sold by weight or in standard containers, and this system is widely used throughout the west.

The conference will also hear addresses on the desirability of compelling manufacturers to mark ''net weight'' on package goods such as twine, shoe polish and other articles not already so labeled under the provision of the food and drugs act. A number of states have enacted laws requiring the net weight of some commodities to be indicated on the package or bottle so that the purchaser may know how much he is getting. The conference will consider the question of a federal statute, which would require such labels on goods shipped in interstate commerce.

A number of automobile problems will be presented. One that is attracting special interest is the use of meters instead of pumps to measure gasoline at filling stations. The conference will also look into the use of bottles which are kept already filled with lubricating oil at service stations, so that an automobile oil tank can be quickly filled while the car is getting gasoline. Some of these bottles are not accurate as measuring devices, which means financial loss to motorists.

ITEMS

DISMAL SWAMP, the great fresh-water marsh south of Norfolk, Va., is to undergo a scientific investigation to determine its economic utility and resources. A party of experts in various branches have been making a survey of this 700-square-mile tract. Among those in the party were R. J. Horsley, chairman of the Waterpower and Development Commission of Virginia; Dr. W. A. Nelson, state geologist and professor at the University of Virginia; Chapin Jones, state forester; Professor Ivey F. Lewis, of the University of Virginia; Professor Charles E. Seitz, agricultural engineer of the Virginia Polytechnic Institute; J. J. Durzulaitus, waterpower expert. Although fresh water now, the Great Dismal Swamp was part of the Atlantic Ocean in a previous geologic era. In it is located Lake Drummond, more than two miles across.

THE real merits, if any, of voodooism as practiced in Africa may be brought to light by a unique research in progress at the University of Witwatersrand. Professor J. M. Watt, of the department of pharmacology, has undertaken to find out the actual medicinal value of all the herbs, plants and other charms used in the semi-barbaric religious rites of the natives. He has sent out several thousand questionnaires to all parts of the continent, asking all who are interested to send in material. The response has exceeded every expectation, and specimens have poured in from all over Africa, over a thousand coming from North Rhodesia alone. It will probably take years to go over the vast amount of material accumulated, but it is hoped that when results of the investigation are eventually published some drugs may be found whose virtues are at present unknown to the medical profession.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE AMERICAN HEALTH CONGRESS

TELEGRAPHIC REPORTS BY WATSON DAVIS

Managing Editor, Science Service

To the health of 110,000,000 people the sessions of the first American Health Congress, opening at Atlantic City, were devoted and dedicated by the sixteen national participating organizations of doctors, nurses, psychiatrists, scientists and laymen.

A revolution in public health was proposed in the opening address of Dr. Lee K. Frankel, of New York, chairman of the National Health Council, when he urged that out of cooperation of the many associations promoting national health there should come a national body militant for the bodily and mental well-being of every inhabitant of the country.

Just as health and charity organizations have combined more effectively to conduct their work and raise necessary funds, so the national united organization would unify and make more effective and economical a concerted unified attack on all diseases. Reorganize the individual so that he is a health unit instead of a potential sufferer from any particular disease, Dr. Frankel urged in saying that the national association would allow the health worker to visualize the eradication of heart disease, tuberculosis, cancer, venereal disease, child mortality and insanity not as separate entities but as maladjustments of the human organism which require unified and concerted effort for their eradication.

In this national health association some see the first step toward making real the health workers' dream of a united federal department of health.

The rescue of children and babies from preventable death now so successful that only one dies where two died a generation ago, was declared by Sir Arthur Newsholme, leading British health authority and official, to be a more urgent subject for public health work than even the prevention of cancer. Nearly a quarter of all deaths of human beings occur before they are six years old, he pointed out, whereas cancer kills the majority of its victims when they have paid back their economic debt to the community, generally with a balance of work for the community to their credit. But, he continued, if out of the cancer researches now in progress there comes a practical prophylaxis, then the prevention of cancer will rank with child hygiene, tuberculosis control and venereal disease prevention as one of the four most important branches of health work.

The public health workers, like the physicians in the field of individual health, carry and apply to the general public the findings of science. In the sessions of the week, little children who won't mind their parents, eyes that can not see, minds that do not function, bodies that are ill, were discussed. And as a result thousands will be made better and happier.

Specifications for the normal, natural child of America were demanded by Herbert Hoover, war-time foster father to 15,000,000 European waifs and now president of the American Child Health Association as well as secretary of commerce.

"Parents would like to know what the normal is in children," he told the American Health Congress. "If we only knew it would give a new orientation to all child health endeavors and would transform our thinking from deficiencies to positive terms of an ideal."

This normal child, which Mr. Hoover believes should be defined, is neither the perfect nor the average child. Mrs. Jones's Mary and Mrs. Smith's John will be able to achieve this normality, yet the normal child would be superior to the average child of to-day.

Draft figures which showed that 80 per cent. of America's men were below normal physically contrasted with the fact that 80 per cent. of all babies born in America are born perfect has shocked the illusions of those who had believed that our country of fine climate, abundant food, little poverty and great devotion to children could not help but produce a fit population. With all these advantages enjoyed by ten million American children of pre-school age, yet malnutrition exists in 20 to 25 per cent., postural defects occur in 40 to 50 per cent. and 60 to 70 per cent. have caries.

"Our work is racial defense," Mr. Hoover said. "If we want this civilization to march forward toward higher economic standards, to moral and spiritual ideals, it will march only on the feet of healthy children. The breeding ground of the gangster is the over-crowded tenement and subnormal childhood. The antidotes are light and air, food and organi ed play. The community nurse and the community safeguard to health will succeed far better than a thousand policemen."

Whether indignation at the prohibition law has caused a popular revolt against restrictions for the common good and thus affected public health measures was a question raised by Wm. J. Schieffelin, of New York City, who spoke on public health from the viewpoint of a layman. He cited the 43,000 cases of smallpox in the United States last year as a serious indictment against the public since every one of the cases was preventable. He urged health endeavor to avoid fads such as anti-tobacco propaganda since most people will discount all the rest if they are told what their experience has taught them is untrue.

One of the great farm crops of this country is children, R. W. Dunlap, assistant secretary of agriculture, told the health workers in announcing that the federal government department of agriculture is turning part of its efforts toward making the farm a better home for human beings.

"Farms are growing, training, educating and turning over to the cities at working age from 300,000 to 400,000 young folks each year," Mr. Dunlap said. "The farms of the middle west are literally the breeding grounds of the nation. Our greatest wealth is in the children of the next generation. The blood and education with which they are equipped determines in the long run whether our civilization is going up or down."

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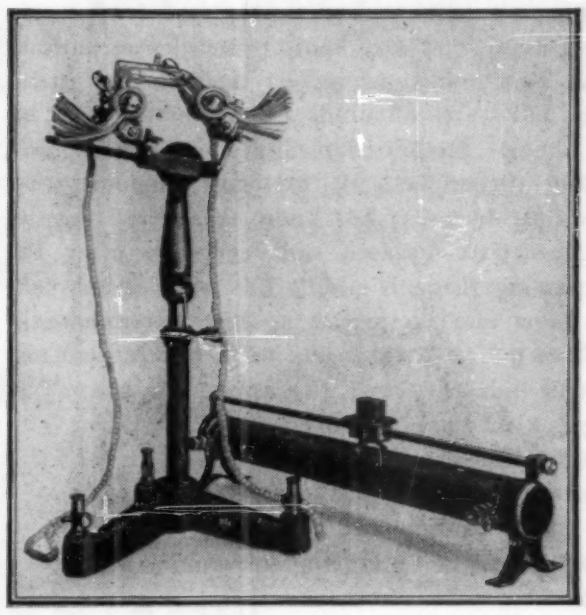

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An intelligence test on health for the educated person was devised and given to the congress by Dr. Livingston Farrand, president of Cornell University. It takes the form of a modern decalogue on health, which, condensed, is as follows:

(1) Know physiological basis for sound health habits, such as sleep, posture, exercise and proper elimination; (2) know types, amounts and proportions of food essential to proper nutrition; (3) know principles of normal mental action and conditions underlying common variations from normal states of mind; (4) understand sex instinct; (5) know factors determining infection and resistance and principles of artificial immunization against infectious diseases; (6) know causes and prevention of degenerative diseases sufficiently to offer the prospect of passing through middle life without a breakdown; (7) know and be armed against environmental hazards, such as polluted water and milk, housing congestion, poisons in industry, etc.; (8) appreciate the necessity of frequent medical and dental examinations; (9) choose wisely medical and dental advisers and realize that the modern practice of medicine is grounded on science, not on mystery, fancy and tradition; (10) know important health problems facing the community and methods of attack.

Three of the principal disease menaces of childhood, measles, scarlet fever and diphtheria, have now succumbed to potential control by man through the application of recent medical advances.

There is now little excuse for a child to fall ill with diphtheria. The doctor and the public health worker have sure-fire weapons to be used against this disease, both before the illness begins and afterwards. Thousands of school children in the last few years have been given harmless injections of diphtheria toxin-antitoxin, and Dr. William H. Park, New York City health official, announced to the congress that in New York the deaths have been cut down to one third and the cases to one half of what they were in 1919. Before the development of the toxin-antitoxin combination that makes children immune until they have outgrown the greatest diphtheria danger ages, antitoxin administered at the first sign of the disease cut down deaths to one fifth.

"The end of diphtheria would come about if physicians should immunize children when they reach nine months of age so as to protect them at the most susceptible period of their lives," Dr. Park said.

Since diphtheria is essentially a disease of the cities, Dr. Matthias Nicoll, New York State health commissioner, explained how the state's campaign for "No diphtheria by 1930" was being waged principally in the centers of population.

Following the same path blazed by diphtheria prevention, there is now being applied a test, cure and preventive of scarlet fever. Drs. Dick and Dick, husband and wife on the staff of the Leander McCormick Institute for Infectious Diseases, Chicago, three years ago discovered the germ causing scarlet fever, and devised toxin and serum for detecting, preventing and treating the disease. As yet the work of the Dicks has not been sufficiently used in actual cases on a large scale to allow it to become a part of the general defenses of the public, but Dr. John A. Kolmer, of the University of Pennsylvania, told the health workers that the prospects of conquering scarlet fever in the same way that diphtheria is being overcome are splendid.

Measles has long been considered one of the minor ills of youth, but it is now realized that although uncomplicated cases are not particularly dangerous, the after effects of pneumonia, ear trouble and laryngitis make it one of the major hazards of childhood. The success reported by Dr. Rowland G. Freeman, of New York City, in the use of blood from persons recovering from measles in protecting others against the disease has created interest among the experts. The blood of the convalescents has been found to protect 50 to 85 per cent. of those treated, whereas all but 2 to 4 per cent. of those unprotected by either serum or previous disease contract it after exposure. At present the serum, limited in quantity because of the fact that no animal can be made to contract the disease, is being used only to protect infants and sickly children who would not live through the measles.

Sanitation is causing typhoid fever to vanish rapidly; through vaccination, Jenner be praised, smallpox is now a disgrace rather than a misfortune and only the carelessness and gullibility of the public have prevented its elimination; plague, cholera and other curses of the ages are kept out of America by Uncle Sam's careful health cordon at our frontiers.

Even tuberculosis, the great white plague, does not kill the large percentages that it once did, for, while a vaccination has not been developed to combat it, three quarters of the incipient cases can be cured in the best sanatoria and campaigns for prevention have been successful. Calmette, heading the great Pasteur Institute at Paris, has at last given us a really scientific and valuable procedure for the artificial immunity against it that some believe will be valuable in protecting the cows of the country or even human beings under certain conditions.

Unhappily there is a small group of infectious diseases that man still must bow to. Influenza, pneumonia, other respiratory diseases, infantile paralysis and sleeping sickness are practically beyond human control.

Cancer, an increasing cause of death, is as yet not under control. X-ray and radium, as well as public enlightenment as to its dangers, have caused some hope, but Dr. Francis Carter Wood, of Columbia University, described the cancer situation as quite unsatisfactory especially since radium and X-rays do not produce a large percentage of cures. The heart has been always considered a vulnerable portion of the human body, but the fact that two per cent. of the population is diseased in this organ places heart trouble in the class of mankind's major afflictions.

Science, despite its conquests, still has work to do.

Man can not live by food alone. He must have light in order to grow healthily, strongly and happily. The kind of light that the eyes can see will not do; it must be invisible light shorter than that to which the eye is tuned and it constitutes less than one per cent. of the total rays of the sun.

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This fraction of the output of the sun stands between health and possible illness for all of us, but children, growing and fighting against diseases to which adults have become hardened, need the protective radiance of this particular part of the solar spectrum. To the American Health Congress the latest knowledge of the part that ultra-violet light plays in health was reported by those carrying on the latest scientific experiments.

Within the last generation realization of the importance of light dawned upon health workers through the nearly miraculous cures that nakedness in the sunshine brought to sufferers from the serious sort of tuberculosis that invades bones and blood. Dr. William J. Bell, deputy health minister of Ontario, Canada, told how the eighty-nine of the first hundred soldier sufferers from surgical tuberculosis who were given the sunshine cure are now back at work.

At another convention along the Atlantic City boardwalk, the electric power and light engineers have listened to reports that show that the visible light of the electric lamp is also a health aid through preventing accidents in street and factory and preventing eye strain at night work and on dark days.

The electrical power house can pinch-hit for the sun in providing invisible light of therapeutic powers when this is necessary. Since in winter and at nearly all times except at midday in summer and especially when smoke, dust and moisture fill the air the sun's curative rays are few and feeble, the ultra-violet lamp is being used as a substitute for the sun.

One of the much-heralded vitamins, that preventing rickets, is produced when ultra-violet light falls on cholesterol or phytosterol, essentials of animal and plant life, and this bottling of sunshine makes scientists feel that they are closer to solving one of the problems of life.

The popular superstitions about the effects of moonlight, how fish and timbers rot more readily in moonlight than in dark, for example, may contain valuable hints to science, for some investigators find that polarized light vibrating in one plane only, as moonlight does, makes plants grow faster and starch change to sugar. In this there may be a disease antidote of the future. To Professor John W. M. Bunker, of the Massachusetts Institute of Technology, the shortest rays known to science just discovered by Millikan suggest a new tool that may be of use to future guardians of health.

Without the invention and discovery of new weapons against disease, the business of living could be made more successful simply by the application of what we know.

Dr. Sheppard W. Foster, of Atlanta, president of the American Dental Association, stated that in addition to protecting against various forms of indigestion, neuritis, malnutrition, rheumatism, mental trouble and other disturbances due to poor teeth, proper care of the teeth in childhood would be a profitable investment to schools because it reduces the number of those pupils who habitually repeat grades. He estimated the cost of teaching these curable repeaters at more than a million dollars annually.

America's great army of mental defectives, numbering about a million, can best be handled by the awakening of the social conscience to the scientific interpretation of facts all of us know, Dr. Charles P. Emerson, president of the National Committee on Mental Hygiene, told the congress in evaluating the status of mental hygiene work. Employers, teachers and courts should recognize the limitations of the feebleminded, he urged, and treat them as children of their mental age. No new laws are needed since those written years ago cover these cases. And the feebleminded, placed under proper guardianship and prevented from adding to the population, will make good citizens within their capabilities.

Realization that microbes know no international boundaries and that one pest spot may infect the whole world is causing health experts to consider the whole world as a unit in inaugurating defensive or offensive health program.

The most effective international cooperation in the whole realm of relations between countries occurs in the field of health. Three great projects for international health are under way, each in its own field, and already many diseases have been chased to the frontiers of civilization into the areas still under the rule of the medicine man instead of the physician.

To-day an epidemic in one part of the world causes an immediate preparation in a distant country to which, in spite of its geographical remoteness, a fast liner may carry it as rapidly as the mails. Cable and radio beat the germ on its foreign foray. To-day the methods of disease control and prevention perfected in one country are quickly applied to another, for experts are given the opportunity to travel from one country to another and through seeing and personal contact absorb for the benefit of their fellow countrymen the latest weapons for health. To-day methods of arousing public conscience and interest that prove successful in one country are shared with all other nations of the world.

The world board of strategy and general staff for health is the health committee of the League of Nations that meets every six months at Geneva. Uncle Sam has not consented to sit at the political councils of the nations, but he has two representatives on this important board, Surgeon General Cumming, of the U. S. Public Health Service, and Dr. Alice Hamilton, professor at the Harvard School of Public Health, and an expert upon industrial conditions and diseases. Dr. Hamilton told the congress that at Geneva, a Pole, Englishman, German, American, Swiss and Italian are in active charge of the committee's work which includes interchange of health statistics, standardization of medical sera and drugs so that a doctor, no matter where he may be, may prescribe the proper quantity and quality of medicine, and many other activities.

"The committee is an international body in every sense of the word, uninfluenced by national politics and the prejudices left by the war," Dr. Hamilton said. "It is carrying on work which is not only intrinsically valuable but which should make for international goodwill and understanding."

An American organization, the International Health Board of the Rockefeller Foundation, has played a large part in the inauguration of international health cooperation through aiding governments to secure the best equipment and personnel for public health and promoting

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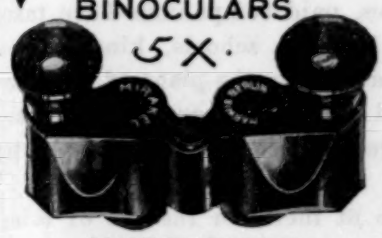

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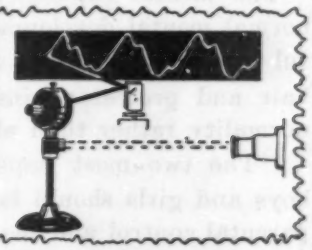

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health campaigns and research throughout the world. Dr. George E. Vincent, president of the Rockefeller Foundation, told the congress in addition to the progress of international congress, the leading nations of the world are giving increased attention to health administration and placing trained sanitarians in charge of the health of their peoples.

The Red Cross is the symbol of international health cooperation throughout the world, and Dr. René Sand, secretary general of the League of Red Cross Societies, told the congress how, under its banner, the propaganda for health has been made world-wide. School children of thirty-seven nations are taught to care for their own health and that of others by the Junior Red Cross. While primary health activities are left to the official agencies, the creation in the masses of men, women and children of a desire for a healthier and loftier standard of life is a function of the Red Cross.

Remarkable and promising as medical and health advance has been in the past fifty years, all stages of belief, sanitation and health practices exhibited in the course of this country's history can be found existing in the world to-day, Dr. William F. Snow, director general of the American Social Hygiene Association, pointed out. And he issued this warning: "It is not unreasonable to predict that the next 150 years may see us return to an age of pestilence and short life span unless we effectively teach each generation fully to understand and to apply the scientific bases for our knowledge of health conservation."

In the same vein, Dr. Vincent said: "He would be hopeful indeed who should at the present time see anything like a millennium of human brotherhood; but at any rate it is obvious that the tendencies now to be seen in the world toward cooperation for health can not fail to draw scientific men everywhere into closer comradeship. So much is clear gain. There is reason to hope that for a time at least the resources of science will be turned from the destruction of human life to the healing of nations."

Dad and mother are largely to blame. The responsibility for the "flaming youth" era of to-day rests in a large measure upon the parents in the opinion of the mental hygiene experts who have spoken this week at the American Health Congress.

The mental experts who have studied the matter of normal mental development see in the wide-spread youthful rebellion of to-day, manifested by frankness, bobbed hair and protest against parental control, evidences of normality rather than abnormality.

"The two most important aims in the education of boys and girls should be the gradual emancipation from parental control and the achievement of a healthy heterosexuality," Dr. Frankwood E. Williams, medical director of the National Committee for Mental Hygiene, declared. "Reckless behavior, while undesirable in itself, is not, in many cases, necessarily a sign of moral depravity but of a healthy tendency toward normal adulthood. Some of the wild things the adolescent may do may themselves be wrong, but they are the symptoms of the emergence of a very desirable factor in the developmental period of life."

During the mauve decade of the 1890's the interest seemed to be in making people good, particularly pure, Dr. Williams pointed out. The world seemed to be convinced of the depravity of all human nature and to lack confidence completely in the fine possibilities of a human being if he could be given a chance to grow and develop. Dr. Williams said that to-day it is recognized that our parents and grandparents got the cart before the horse and that now the thing to do is to see that people are physically and mentally well. If this is done, the rest will take care of itself.

The cradle is the proper place to start training a child. Personality and viewpoint of the world is developed in the first two or three years of life rather than at a later age when failure at proper training may become apparent. In this work the parents have great responsibility, which they are not always ready to asuume.

"The home as such has lost to a very great extent its great stabilizing force in the development of the personality of the child," Dr. Douglas A. Thom, of the Massachusetts State Department of Mental Diseases, said. "Nurse maids, governesses, paid companions have taken the place of parents. Nursery schools, kindergarten, boarding schools, camps have taken the place of the home. The child has been farmed out for its moral, spiritual and intellectual training in pretty much the same way as the family washing."

Training for parents to fit them for the job of bringing up their children was suggested by Dr. Christine M. Leonard, of the All-Philadelphia Child Guidance Clinic. She urged that parents should realize that they may consciously or unconsciously mold the child's future by their own emotions and desires and that this may be harmful to the child. Children are human beings, after all, and they have thoughts and feelings of their own which should not be subservient to the self-satisfaction of the parents.

The experts vindicated the child who is always curious. Curiosity is the heritage and possession of all children with the possible exception of the idiot and no matter how excessive the curiosity it can hardly be considered pathological. According to Dr. Edward A. Strecker, of the Jefferson Medical College, Philadelphia, the general assumption that sex curiosity is abnormal is erroneous.

"Usually children are more curious about sex than about other matters simply because sex has been attractively clothed in mystery," Dr. Strecker said. "One does not face the question as to whether sex curiosity is to be satisfied or not. The real question is will it be satisfied in a natural constructive manner or is the child to be left to tap over available and harmful sources of information."

Some of the qualities of mentally sound children were given by Dr. Strecker. There should be included in their make-up the ability and the desire to move, a certain readiness and willingness to imitate, some response to suggestion, a strong leaven of curiosity, an appreciable love of power, a dash of savagery and a seasoning of romancing. There should be intelligence enough to bring out these traits; enough emotional virility to impress the lessons which they teach and moral judgment to act as a kind of partial check. The marked diminution of these characteristics is a much safer measure of a sick mind than is their excess.

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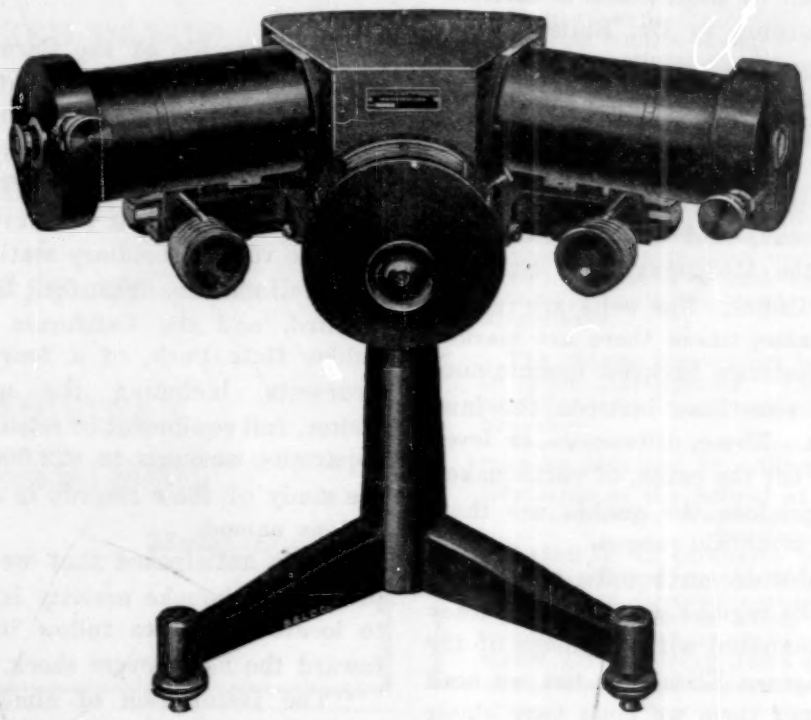

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SCIENCE NEWS

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MICROTREMORS

STUDYING earthquakes in California, as with a microscope, to learn their whims and so to help prevent such damage as that in San Francisco in 1906 and in Santa Barbara in 1925, is the program inaugurated in the region of Los Angeles by the Carnegie Institution of Washington and now being introduced by local business interests around San Francisco, according to Dr. Bailey Willis, professor emeritus of geology at Leland Stanford University, and president of the Seismological Society of America.

"Earthquake centers are located in belts," Professor Willis told a representative of *Science Service*, "one belt surrounding the Pacific Ocean, and another extending across Southern Asia and the Mediterranean. Still another belt crosses the West Indies. The belts are related to zones of growing mountains, where there are marked differences in elevation, sometimes between mountainous regions and lowlands, and sometimes between the land and the bottom of the sea. These differences in level, however, are the effect, and not the cause, of earthquakes, because the forces which produce the quakes are those engaged in pushing up live mountain ranges.

"As a result of a world-wide earthquake survey, we now have maps of earthquake regions which for accuracy and completeness may be compared with the maps of the continents in the time of Queen Elizabeth, but we need much better maps, and to get them we must have closer surveys. For that purpose we have need of a new type of instrument or seismometer.

"In designing this new type, the experts of the Carnegie Institution have resorted to a pendulum which scarcely weighs an ounce and is attached to a tungsten steel wire as fine as a spider's web. It carries a small mirror which reflects a pencil of light and the latter draws the record on a moving photographic film. In size and weight the instrument is exceedingly strong, and yet it offers no large mass by which an earthquake could destroy it, as is the case with older designs.

"It has thus been made possible to record a microscopic earthquake, and we might well call the operation the study of earthquakes with a microscope. These microscopic earthquakes are called microtremors. They occur constantly in earthquake regions and frequently in other places, as on the Atlantic Coast. Their frequency and intensity is a gauge of earthquake activity.

"When we know more about them, we shall be able to follow these minute elastic vibrations very much in the same way as the Weather Bureau now follows fluctuations of the barometer. We expect that in time we shall be able to tell from them the approach of an earthquake 'storm,' and thus may come nearer to forecasting quakes —something which is now impossible.

"With a view to making a local survey, the Carnegie Institution is establishing four stations in Southern California, at Pasadena, Riverside, La Jolla and, probably, Catalina Island. The range of each station for microtremors is about fifty miles, and of course longer for heavier shocks. The four stations will therefore cover the whole of the coastal region of Southern California, and from their records we shall obtain a good knowledge of the distribution of earthquake activity. One of the instruments at Pasadena recorded two hundred microtremors in its first twelve months of experimental operation.

"The example of the Carnegie Institution led to an active campaign for the installation of modern seismometers around San Francisco Bay, and funds have been raised by business men and corporations of the cities on the bay for that purpose. The central station will be located at Berkeley, at the University of California, which will also run a subsidiary station at the Lick Observatory on Mt. Hamilton. Stanford University will take care of a third, and the California Academy of Sciences, in Golden Gate Park, of a fourth. The cost of these instruments, including the necessary earthquake-proof shelter, full equipment of seismometers and time-recording apparatus, amounts to $22,000. Their maintenance and the study of their records is assumed by the three institutions named.

"It is anticipated that we shall thus learn what the present earthquake activity is, and that we shall be able to locate it and to follow its variation as it increases toward the next severe shock.

"The installation of similar groups of instruments, not only in other parts of California, but around Boston, New York, St. Louis, New Orleans, and other great centers of population and property, is one of the things to which business men should give serious consideration, and toward which their contributions would constitute an investment in security."

THE SPIRAL NEBULA, MESSIER 33

THE spiral nebula, Messier 33, in the constellation of the Triangle, which appears now low in the northeastern sky before sunrise, is an independent stellar system, similar to that forming the Milky Way, of which the sun is a part, but much smaller in extent. This is the conclusion of Dr. Edwin Hubble, astronomer at the Mt. Wilson Observatory in California, who will publish his results of several years of study in the forthcoming issue of *The Astrophysical Journal.*

Dr. Hubble has studied Messier 33 with the aid of the 100-inch telescope at Mt. Wilson, as well as another spiral nebula in the constellation of Andromeda. Both of these nebulae can be seen faintly with the unaided eye on a dark clear night, but seen with a telescope they appear merely as hazy patches of light. Photographs, however, made with a large telescope, such as one of those at Mt. Wilson, reveal brighter spots against the hazy background, which Professor G. W. Ritchey, formerly at Mt. Wilson, called "nebulous stars."

In his photographs made with the highest powers of the big reflecting telescope, Dr. Hubble finds that these

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"nebulous stars" are just the same as any other kind of stars, and that they may be studied with the same means. Some of these stars vary in light, and thirty-five of them are "Cepheid" variables, stars from which the distance may be determined when the period of their variation is known. This distance is found to be about 900,000 light years, that is, the distance that a ray of light, traveling fast enough to encircle the earth seven times in a second, could traverse in 900,000 years. This places the nebula outside the system of stars to which the Milky Way and our sun belong.

However, Dr. Hubble states that in actual brightness and size, which can be determined when its distance is known, Messier 33 is inferior to the Galaxy, and more nearly resembles the Magellanic Clouds, two clouds of stars which are visible from countries south of the equator, and which are within our system. The diameter of the nebula is about 15,000 light years, while that of the Milky Way system is thought by some astronomers to be as much as 300,000 light years.

RACE CROSSES

ONE of the worst features of race crossing is the fact that it disturbs social inheritance, says Dr. W. E. Castle, of the Bussey Institution of Harvard University.

Biologically speaking, there is no race problem in the United States, he declares in a forthcoming issue of *The Journal of Physical Anthropology*; for when traits blend in human crosses deterioration does not necessarily follow. Instead there is an intermediate degree of the various characteristics involved. The desirability of a particular race cross from a biological point of view depends wholly on whether a greater or less degree of the qualities under consideration are wanted in the resulting offspring, according to Dr. Castle.

"If social considerations were not much more powerful than biological ones," he says, "the future population of the United States would certainly be highly variable in skin color and intelligence, passing by scarcely perceptible gradations from a pure black type of the present 'black belt' to a pure white type such as would result from a mixing of European races. But the social considerations are of much more importance than biological ones in this connection, and the racial future of the United States can not be predicted from the latter alone.

"The prospect is that, if things go on as they now are, the mulattoes will not amalgamate either with the whites or with the blacks but will form a separate but diminishing proportion of the total population. The blacks are holding their own in certain rural sections of the South, but elsewhere are going back numerically. No complete amalgamation of blacks with whites is to be anticipated, simply because of social impediments, though no biological barrier whatever is discoverable."

The crosses between whites and North American Indians are numerically unimportant, Dr. Castle continues, but instructive as a biological and social experiment. The half-breed population that grew up along the frontiers has shown little evidence of physical or intellectual degeneracy, except as influenced by the introduced vices of the whites. There is no strong racial prejudice against the red man as there is against the negro, recently a slave, and in consequence the full-blooded Indian is rapidly vanishing from the population. These different results following the crossing with the black and the red races in the United States are not referable to any biological cause, Dr. Castle maintains, but are due solely to the social attitudes of the whites, which is hostile in one case and indifferent in the other.

He says in conclusion, "A further illustration of the surpassing importance of social over biological considerations in race-crossing is seen in the attitude of the Pacific Coast States towards Chinese and Japanese intermixture. No one questions the virility of these races or their biological fitness. Their cultural attainments are very high and antedate our own. Hybrids between these races and white races, so far as our information goes, are of high quality physically and intellectually. Yet public opinion is unalterably opposed to Oriental immigration or race mixture, not on biological grounds, but purely on social, economic or political grounds."

THE BACTERIOPHAGE

"THE bacteriophage is alive." So maintains Dr. F. d'Herelle, its discoverer, fronting the skeptical criticism of many other men of science, in his new book on the subject. The bacteriophage is alive, and no mere chemical phenomenon; and it maintains itself, he says, as a parasite of parasites, a deadly submicroscopic germ that kills other germs. No culture of bacteria can be "pure," as far as the bacteriophage is concerned; it is harder to find a germ without its bacteriophage accompaniment than it is to find a woolly dog without fleas in summer.

But the bacteriophage is not a mere annoyance to the germs it infests, according to Dr. d'Herelle. It kills them, just as some germs kill men and animals and plants, and then it dissolves their corpses. And just as there are special germs that attack men and not horses, and others that attack horses and not sheep, so there are special breeds of bacteriophage, each of which has a favorite germ which it attacks. But just as some germs, for example anthrax, will attack men, horses and sheep indiscriminately, so there are some varieties of bacteriophage whose appetites are equally indiscriminate, permitting them to devour several different species of bacteria. Dr. d'Herelle claims that he has succeeded in isolating single bacteriophage "corpuscles," and in breeding up pure cultures of these different strains.

According to the author, these "super-germs" are almost unimaginably small, having diameters of 20 thousandths of a thousandth of a millimeter. They pass readily through the pores of a very fine porcelain filter, that will stop ordinary germs. But one of these tiny organisms, he says, will penetrate into the body of a bacterium, and there will divide and divide again, just as a germ does in the body of a man; until the bacteriophage "family" becomes so numerous as to burst the unfortunate bacterium asunder and so cause its death.

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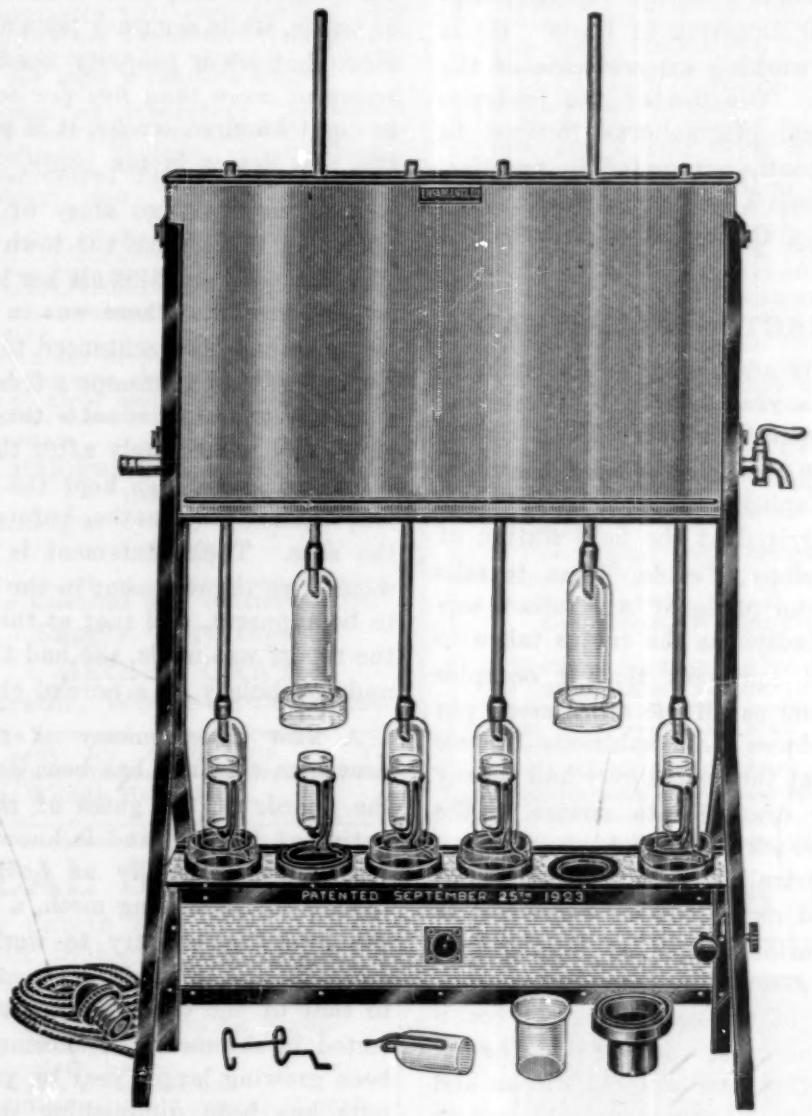

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more strains of bacteriophage that make war on their commonest germ enemies. When the germs get the upper hand of the bacteriophage, we are sick; when we are convalescent, Dr. d'Herelle says, our private bacteriophage strains are in a state of especial virulence against their special germ victims.

Dr. d'Herelle made his discovery of the bacteriophage while he was at the Pasteur Institute in Paris. He is now at Alexandria, Egypt, working on problems of the control of tropical diseases. The use of the bacteriophage for combating tropical plagues was forecast in literature before it was actually attempted in practice, for the hero in Sinclair Lewis's novel, "Arrowsmith," is sent on an expedition to a Caribbean country to put down an epidemic.

THE PRICKLY PEAR CACTUS IN AUSTRALIA

THE prickly pear cactus is advancing in Australia at the rate of a million acres a year. Leith F. Hitchcock, of the Australian Commonwealth Prickly Pear Board, estimates that already 60,000,000 acres of East Australia alone are infested with this spiny pest.

Mr. Hitchcock has just arrived at the field station of the U. S. Bureau of Entomology, Uvalde, Texas, to take charge of the North American phase of Australia's war on the prickly plant. So kindly has the cactus taken to the climate of the isolated continent that it occupies more than twice as much land as all the other crops put together, and so desperate have the inhabitants become that every sort of enemy that the cactus ever had in any part of the world is being drafted into service in the wild hope that it will help check its spread.

For that purpose the Australian Prickly Pear Board has sent out men to the arid regions of the southwest to collect specimens of the various types of insects that prey on the prickly pear. Thus far, according to Mr. Hitchcock, different species of the mealy bugs or cochineal insects have been found most successful. The insects are grown in cages at the entomological station and the most vicious attackers of the cactus are shipped to Australia. There the authorities, taking warning from the rapid increase of the artificially introduced rabbit and the cactus itself, grow the insects in quarantine through at least one generation before they turn them loose to do their worst.

ITEMS

TEMPERATURE conditions of the Pacific Ocean between Los Angeles and Honolulu will be studied by means of a thermograph installed on one of the passenger ships plying that route by Director T. Wayland Vaughan, of the Scripps Institution of Oceanography at La Jolla, Calif. The thermograph will bring important information to science and shipping men, according to Dr. Vaughan, in that it will give continuous information concerning temperature, which will aid in making weather reports for the Pacific Coast.

THE weighing of overloaded trucks right on the road is the latest method of attack on this problem of the highways, according to discussion by experts at the National Conference on Weights and Measures held recently in Washington. The damage to streets and highways caused by overloaded trucks has led to the fixing of maximum loads in many regions, and to the development of special devices for the expeditious weighing of trucks caught in the act of exceeding the load limit. These portable scales enable the highway department inspectors to ascertain the weight of suspected trucks without undue holding up of traffic, while accuracy tests at the Bureau of Standards show that when properly handled they should not show errors of more than five per cent. either way. As many as eight hundred trucks, it is said, have been weighed by this new device in ten hours.

A GLAND-GRAFTING story of dramatic character is reported in Paris from the town of Lille. A nine-year-old girl had been an idiot all her life, due to certain glandular deficiencies. There was in the prison at Lille a convict who had been sentenced to the guillotine. Local surgeons decided to attempt a transplantation of the thyroid gland from the criminal's throat, under the skin of the child, and immediately after the execution this was done.

The surgeons then kept the child under close observation for several months, before they undertook to report the case. Their statement is that at the end of three months an improvement in the child's mental state began to be apparent, and that at the end of nine months, when the report was made, she had the understanding, behavior and vocabulary of a normal child of her years.

A NEW insect enemy of the already sadly plagued American chestnut has been caught trying to sneak past the guards at the gates of the United States. It is a native of Europe, and is known as the nut fruit tortrix, or more scientifically as *Laspeyresia splendana*. It is related to the codling moth, a foreign pest that long ago got into this country to work ruin in American fruit orchards, and its work on the chestnut is said to be similar to that of the codling moth on fruits. It has been detected in shipments of chestnuts from Italy, which have been growing larger year by year as the supply of native nuts has been diminishing due to the ravages of the chestnut blight disease. The Federal Horticultural Board is now considering the possibility of enforcing restrictive measures against the importation of European chestnuts.

THE cause of a certain kind of skin infection, known to physicians as "creeping eruption" is due to a tiny threadworm, scientists have just found. *Agamonemtodum migrans* is the name bestowed on the parasite by its discoverers, Drs. J. L. Kirby-Smith, W. E. Dove and G. F. White. In a report to the *Archives of Dermatology and Syphilology* they say that this species of cutaneous worm is fairly common in the southeastern and southern coastal states. Susceptibility to the infection varies, children being the most frequent victims. Whites are infected more readily than Negroes, it was found. The evidence at hand points to rats as the hosts of the adult form of the worm, though any one of the smaller domestic animals may be incriminated as the guilty harborer of the pest. Several modes of treatment have been proposed, but successful prevention of the infection will probably not take place until there is more knowledge of the life history of the adult parasite.

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SCIENCE NEWS

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CRYSTALLINE INSULIN

INSULIN has been reduced to a purity so great that it comes down out of solution in the form of minute crystals that shine like bits of uncut diamond when viewed through the microscope. Yet this result has not satisfied Dr. John J. Abel and his corps of coworkers at the school of medicine of the Johns Hopkins University. They expect to spend the coming two or three years, at least, investigating the properties of those crystals.

The insulin used in medicine is effective clinically, Dr. Abel told a representative of *Science Service,* but it has been recognized from the first that chemically it is far from being a pure product. Most chemical compounds indicate the attainment of a state of real purity by forming regular crystals, and nobody had been able to get crystals of insulin. The trouble was, Dr. Abel explained, that the insulin was all mixed up with a lot of other unknown substances that would precipitate at very nearly the same electro-chemical state of the solution.

Beginning with the ordinary insulin used in medicine, Dr. Abel and his associates passed it through an elaborate series of precipitations with various chemicals and repeated solutions in weak acetic acid. The crystals that come down at the last stage are very small. After settling out at the bottom of the flask they were picked up with a fine-pointed, rubber-tipped medicine dropper. The process of manufacture is so slow and difficult that months of work have resulted in the preparation of only a few hundred milligrams of the precious stuff.

This pure crystalline insulin is extremely potent, Dr. Abel states. One milligram of it, or a bit as large as a rather small grain of sand, has as much power to reduce blood sugar as is possessed by 100 clinical units of the solution used in medical practice. One fiftieth of a milligram will throw a 4½-pound rabbit into convulsions, which are quickly cured, however, by injecting a little sugar solution into the rabbit's veins.

Whenever a chemist succeeds in refining a natural compound to a purity that will result in crystal formation, the next step is usually expected to be the analysis of the crystals, with a view to the possible manufacture of the compound by artificial means, so that a perfectly uniform product may be obtained at a lower price. But Dr. Abel states that a year or more of work must intervene before the analysis can be completed. The synthesis of the compound will undoubtedly be a matter of the greatest difficulty and may be impossible in the present state of our knowledge.

Dr. Abel is no novice in the field of purification of gland secretions. Three of the four extracts of the various ductless glands so far crystallized or brought to a very high concentration are checked up to his credit. In addition to the recent crystallization of insulin, he isolated epinephrin as a mono-benzoyl derivative from the extract of a ductless gland situated near the kidneys, and he has also prepared a highly purified and very potent tartrate, not yet crystalliized, from extracts of the pituitary body. The fourth internal gland secretion to be purified is thyroxin, the extract of the thyroid gland of the throat region, which was crystallized by Dr. Edward Kendall, of the Mayo Clinic.

A MEASLES SERUM

ANOTHER weapon that may help to ward off the measles epidemics that sweep over the country in irresistible waves nearly every year is described by Dr. Rowland G. Freeman in a report to the American Public Health Association and the American Child Health Association.

Since the incidence of measles is greater than that of any other infectious disease, and 96 to 98 per cent. of those who have not had the disease contract it after exposure, any agent that promises to hold it in check comes immediately into the limelight.

The mode of attack set forth by Dr. Freeman consists of injection with a serum made from the blood of adult measles convalescents. This serum acts as a preventive. This method was first used in Germany in 1916 where the percentage of immunity conferred was found to be as high as 85 per cent. When the New York Board of Health began work on the problem in 1923 it found that the first difficulty was to find a sufficient source of convalescent blood to make the serum. A suitable reward was offered to adults suffering from measles in the contagious wards of all the hospitals in New York. Eventually enough was collected to treat in all about 3,500 children.

The most reliable data collected from these cases show that over 50 per cent. were completely immune, about 40 per cent. had only mild cases and in relatively few did measles develop in the usual unmitigated form. None of the children who had been injected with the serum suffered any of the after complications of pneumonia or ear trouble that make measles really dangerous, particularly in very young children.

In the light of the difficulty of obtaining material and the fact that the passive immunity conferred by the serum lasts only from three to six weeks, its use is limited quite largely to infants and children who are too delicate to stand any illness. It has a great field of potential use in checking measles epidemics in institutions, but for the present the supply of serum is inadequate to meet the demand. "We have in convalescent measles serum a therapeutic agent which has great usefulness in a limited sphere," Dr. Freeman said; "it is not the solution of the measles problem but it is a real step toward cutting down the mortality from this disease."

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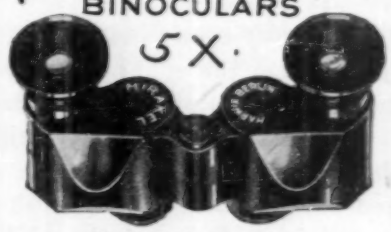

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While the process is fatal to all microbes if continued long enough, Dr. Cleveland has found that the pathogenes, or disease-causing germs, are the easiest to destroy. High pressures or long exposure periods kill the germs completely, while less drastic treatment will leave them alive but unable to multiply; that is, it will preserve the material without absolutely sterilizing it.

Dr. Cleveland did not discover this process suddenly; it came as the result of a long series of experiments. The first inkling of the principle underlying this new method of preserving fruit juices was discovered while he was studying the minute, one-celled animals or protozoa that live in the digestive tracts of termites or white ants. He wanted to get the insects free of their tiny guests, and tried various methods, including heat treatment, with success. He found finally that if he increased the oxygen present in the atmosphere of the jars in which they were kept, the insects would live while the protozoa inside them died. The difference in the effect of oxygen on the microorganisms in white ants and on the white ants themselves was very great; the ants survived more than forty times the amount of oxygen required to kill their intestinal guests.

Following this, Dr. Cleveland very soon discovered that many other animals, including even the cold-blooded vertebrates among the higher animals, lost their protozoa when confined in oxygen. Applications of this principle may be made in combating the diseases of economic insects such as silkworms and bees, in freeing young fish of disease-causing parasites, and in testing out the ability of insects to transmit protozoa and spirochaetes to man, animals and plants.

Turning from the study of the killing effect of oxygen on parasitic microorganisms, Dr. Cleveland found that it was possible to kill such organisms as bacteria, molds and yeasts living free in nature by confining them in oxygen under pressure. This suggested the query "Is is possible, without rendering food unwholesome, to kill the microorganisms which cause it to spoil?" The work on fruit juices is an answer to this question.

THE DISRUPTION OF MATTER

THE universe is running down. Presented as a purely scientific conclusion, such is the statement of Dr. Richard C. Tolman, noted physical chemist of the California Institute of Technology, in an address to the Sigma Xi scientific society at Pasadena, California. Dr. Tolman admits this conclusion is probably untenable for a philosopher, who would want to know "who wound the universe up"; or if nobody wound it up, how could it have been running down for an infinite period of past time and still operate?

Taking the position of a court of law rather than that of a speculator in thoughts, the physical chemist of today finds no direct evidence whatsoever to deny the apparent fact that matter is being dissipated into a chaos of worthless scattered energy. To be sure, only a few species of matter are being actively destroyed in this manner on earth, but the tremendous radiations of the sun and stars are explainable on no other basis.

Dr. Tolman points out that future research may prove the atoms of terrestrial matter to be amenable to some setting-off process roughly analogous to the touching of a match to gunpowder. Possibly some of the so-called "novae" or new stars, which burst suddenly into view with a brilliance born of terrific temperatures and enormous radiation, may have been set off by a cosmic fuse of some sort. Obviously the control of such forces on earth by man would involve fearful responsibilities.

It is not necessary, in the degradation of matter into scattered energy, that large atoms should always break down into small ones. It is known that hydrogen atoms —the smallest atoms known—of their own free will combine in quartets to form helium atoms, but release in the process nearly one per cent. of their substance. The off-shoot is transformed into an enormous quantity of energy. Recent calculations show that that new cosmic rays, investigated last summer by Dr. Millikan, may well have come from the hydrogen-helium transformation in some distant nebula or star. At least it is known that they do not come from the earth or necessarily from the sun.

The transmutation of hydrogen into helium is very slow in most parts of the universe, so that the accumulated supply of the valuable product is small. The control of the reaction would plainly serve as a tremendous impetus to the airship industry, but the key to the puzzle is not in sight.

PRE-MAYA EXPLORATIONS IN GUATEMALA

THE forerunners of the wonderful Maya civilization in Central America have been discovered. Earthquakes which long ago shook Guatemala may enable archeologists to shove American pre-history back many thousands of years, and thus a new era ripe for archeological research will be revealed.

Such are the probable results of a three months' reconnaissance survey of unknown Guatemala just completed by Dr. Manuel Gamio, leading Mexican archeologist, working under the auspices of the Archeological Society of Washington. Dr. Gamio is now on his way to Washington, where he will study the material he has collected and will prepare a scientific report of his exploration trip.

The survey was for the purpose of determining whether Guatemala is a promising field for pre-Maya explorations. The first reports confirm the conjecture that the Guatemala highlands would yield evidence of ancient human

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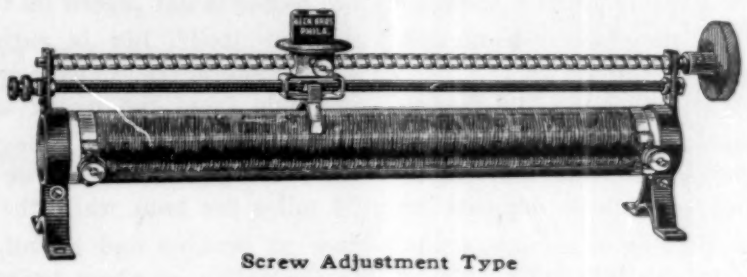

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occupancy, dating back to long before the time of Christ.

What happened in the central region of America before the rise of the Maya, the Toltecs and the Aztecs is literally "pre-history." From time to time clay and stone fragments of great antiquity have been found in Central America, but archeologists have vaguely termed them as "Archaic" which means only that they belong to an age and a people that distinctly preceded the Maya.

In a report to the Washington Society, Dr. Gamio states that he has made several trial excavations, digging through seven strata of deposited soil, each layer being about twenty inches thick. In these deposits he found numerous fragments of pottery and clay sculptures. Many of these are of the Archaic type. There are a few Maya finds. Also, some of the pottery shows signs of a gradual transition to the ceramic style of the Maya, indicating that the two types may have blended or that one developed into the other.

Geography and earthquakes in particular are helping in this tracing of early Mayan history. Exploring this unsettled region, Dr. Gamio has found evidence that "the Maya, able constructors of lofty and complicated edifices, did not, if one may judge from appearances, build anything in the high zones affected by earthquakes. They confined themselves to the lower and above all to the coastal regions, where shocks were not experienced."

Buildings of the Maya remain standing in Guatemala to-day. Dr. Gamio suggests that probably these careful builders profited by the earthquake experiences of the earlier and more primitive people, because the makers of the Archaic pottery had established their settlements with careless disregard of earthquake zones.

It is not yet determined, however, whether these early inhabitants built such simple homes that they did not fear the rocking of houses and the falling of walls, or whether there were fewer earthquakes in that part of the world then.

The part played by earthquakes in the wanderings of these prehistoric American tribes is being closely studied by Dr. Gamio, who says that earthquakes have had a marked influence on the development of human life.

ITEMS

PHOTOGRAPHS of ripples mechanically produced in a tank were used by A. H. Davis, of the British National Physical Laboratory, to find out how to dissipate the noises made by airplane motors at the aerodrome warming-up in preparation to flight. Constructing a model tank comprising the principles of construction of the surrounding buildings, including a hangar, wave-lengths in water to the same scale as the sound waves were produced by ripples. By photographing these ripples it was possible to detect the effect of the various obstacles. In this way shielding effects were worked out by which it was possible to place accurately on the flying field parallel "plates" or sound screens, thus doing away with much of the noise disturbance.

A "SILENT" railway motor car without engine vibrations has been achieved, and during its recent trial run over the Swedish State Railways from Malmoe to Stockholm the passengers heard no other noise than that of the wheels clicking against the rail joints. It is the design of a Swedish engineer, Magnus Tacklind, of Stockholm, but has been manufactured in Germany. Except for certain motor parts it will later be built in Sweden. The absence of the noise and vibration is due to the fact that the motor is not placed on the same frame as the passenger car itself, but is entirely isolated from it, being slung underneath. The power is transferred to the driving axle from the motor through five different sets of gears, which are kept going all the time, so as to make the driving smoother. The speed attained reached over 50 miles per hour while the consumption of fuel, a mixture of benzine and benzol, averaged about eight miles to the gallon, or about twice that of an ordinary taxicab.

THE gaseous products set afloat by the family furnace are likely to have a corrosive action on the book bindings in the family library. According to experiments conducted at the Bureau of Chemistry, the products of combustion which pollute the air in large cities have a very deteriorating effect on the leather of bindings. This may be counteracted by applying various dressings, either while the leather is being made or when the book is bound.

OIL of wintergreen, commonly used in salves and liniments, is extremely poisonous when taken internally even in moderate doses. Drs. N. C. Wetzel and J. D. Nourse report that quantities of less than two fluidounces have resulted in death. The toxic effects of this familiar drug, in frequent use in medical practice to allay pain and reduce fever, seem not to have been generally recognized. They are ascribed to the fact that oil of wintergreen, after being taken into the body, undergoes very little chemical destruction, or breaking up into less dangerous components. Editorial comment in the *Journal of the American Medical Association* says that from the standpoint of public welfare, "Access to oil of wintergreen should be made impossible for children and for persons ignorant of its poisonous properties."

OCCUPANTS of the White House hold the record for longevity, according to statistics on notable men compiled by Pitirim Sorokin, a Russian economist. Their average life-span is almost exactly the Biblical three score and ten. Close on their heels as long-lived mortals are the Popes of the Roman Catholic Church, who average 69.6 years. A third group includes American millionaires, with 69.2 years. Scholars and scientists average 67.3 years, and writing men 64.4. The poorest showing was made by the hereditary monarchs of Europe. Though this group included some very long-lived families, the average longevity was only 53.6 years. In explanation of the poor showing of kings, it has been pointed out that the other groups represent the results of selection. The presidency and the papacy, for example, are both elective offices, and are filled invariably by men of mature years and usually good health, who have made their own records, while monarchs are notabilities simply by accident of birth, and by the same accident of birth may come of stocks decidedly inferior so far as health and vigor are concerned.

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If vacancies occur, students from other institutions desiring advanced standing may be admitted to the second or third year provided they fulfill the requirements and present exceptional qualifications.

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The academic year begins the Tuesday nearest October 1, and closes the second Tuesday in June. The course of instruction occupies four years and especial emphasis is laid upon practical work in the laboratories, in the wards of the Hospital and in the dispensary.

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THE TEMPERATURE OF THE SUN

THE interior of the sun must have a temperature of 70,000,000 degrees Fahrenheit, at the center, which gradually decreases until it is only about 10,000 degrees at the surface. That this is necessary to keep the sun at the size it is at present, and to prevent the gravitating mass of the outer part from collapsing to the center, is the opinion of Professor A. S. Eddington, professor of astronomy at the University of Cambridge, stated in a series of lectures at King's College, University of London.

As a result of this conclusion, says Professor Eddington, "no source of energy is of any avail unless it liberates heat in the deep interior of a star." This, he believes, effectually disposes of an idea, suggested in the past, that the sun received its energy from meteors which fell into it from outer space. "Clearly," he states, "you can not maintain a temperature gradient by supplying heat at the bottom end. If this year the sun encountered a swarm of meteors which bombarded it with enough energy to furnish a year's supply of radiation, that would not add a year, or even a day to the life of the sun; its internal readjustments would go on unaffected. All that would happen would be that the sun would give us twice the normal amount of radiation this year."

The theory once proposed that the sun is gradually contracting, and so releases the energy which forms the heat, is also untenable, says the astronomer, because with such a theory the sun can not be more than 46,000,000 years old. "Physical and geological evidence seems to be conclusive," he says, "that the age of the earth—reckoned from a period which by no means goes back to its beginnings as a planet—is much greater. The age of the older rocks found from their uranium-lead ratio is generally put at 1,200,000,000 years; lower estimates have been urged by Professor Joly, but none low enough to save the contraction hypothesis."

Astronomical facts also support these ideas of the age of the solar system, and so, according to Professor Eddington, "we seem to require a time-scale which will allow at least 10,000,000,000 years for the age of the sun; certainly we can not abate our demands below 1,000,000,000 years.

"Since we can not very well imagine an extraneous source of heat able to release itself at the center of the star, the idea of a star picking up its energy as it goes along seems to be definitely ruled out. It follows that the star contains hidden within it the energy which has to last the rest of its life. But energy can not be successfully hidden; it betrays itself because it has (or because it is) mass. How much of the sum total of the energy of the sun is capable of being converted into radiation we do not know; but if it is all available, there is enough to maintain the sun's radiation at the present rate for 15,000,000,000,000 years. To put the argument in another form, the heat emitted by the sun each year has a mass of 120,000,000,000,000 tons; and if this loss of mass continued there would be no mass left at the end of 15,000,000,000,000 years."

Since all the other alternatives are eliminated, Professor Eddington supposes that the source of the energy must be in the protons and electrons, charges of positive and negative electricity, of which the atoms are composed.

"We have to suppose," he says, "that a proton and electron run together, their electric charges cancel and nothing is left but a splash in the ether which spreads out as an electromagnetic wave carrying off the energy."

He admits the difficulty of some of these ideas, for apparently at a temperature of 70,000,000 degrees the energy is liberated so copiously that he asks, "Can we suppose that energy issues freely from matter at 70,000,000 degrees as steam issues from water at 212 degrees? I think that physicists would be hard put to it to reconcile such extraordinary behavior with any accepted principles, yet that is what the astronomical observations taken at face value seem to insist."

In a reply to this suggestion, Professor J. H. Jeans, president of the Royal Astronomical Society, denies that this can happen, for, he says, the transformation of matter to energy itself is a process which liberates more heat, and, "as soon as the center of a star reached 70,000,000 degrees, the heat generated would raise the neighboring parts to 70,000,000 degrees, these would generate more heat, and so on, the high temperature spreading explosively throughout the star. The true analogy would be, not the issue of steam from water, but the explosion of a magazine of gunpowder."

RADIATION FROM THE SUN

THE sun is a mass of intensely heated gas composed of layers which revolve at different speeds, the outer layer travelling the fastest and the core slowest.

This "revolutionary" idea of the structure of the sun was put forward by Dr. J. H. Jeans, secretary to the Royal Society, at a recent meeting of the Royal Astronomical Society, of which he is president.

Long after Galileo Galilei first noted how sunspots appear to travel across the sun, and concluded that our luminary revolves round its axis once in about twenty-seven days, scientists believed that the sun was a solid body, rotating as a whole, just like our earth. And even when it was realized that the sun was much more like a gas than a solid, it was generally believed that all parts of it rotated with the same speed. Now Dr. Jeans thinks that the sun consists of many layers of gas moving at different speeds, and he justifies this view by the now accepted theory that radiation is of material nature: as such it can not pass freely through the body of the sun, and as it travels from the hot center to the cooler surface it puts an increasing brake on the rotating layers and ultimately reduces the speed of the outer layers to a mere fraction of that of the inner. This reduction in speed with increasing distance from the center reminds us of the planet Neptune, the outermost member of the solar system, which revolves round the sun once in 165 years, the earth once in a year, while Mercury, the innermost planet, revolves once in 88 days.

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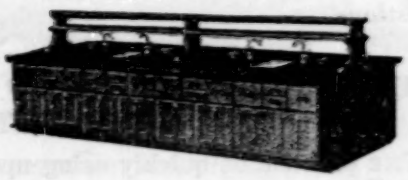

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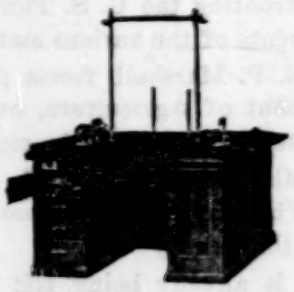

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CHEMILUMINESCENCE

"CHEMILUMINESCENCE" is the term applied to a new kind of light caused by chemical reactions which involve no burning or combustion. The practical application of this principle, according to advices received in London, has been worked out in a factory in Hungary where a tube has been devised in which chemiluminescence reactions can be carried out in a vacuum.

The materials which have thus far proved most successful in this capacity are chlorine gas and sodium vapor. These two elements brought together in this form combine to produce sodium chloride, or common table salt, giving off in the process a brilliant yellow light. About one tenth of the energy involved in this reaction is converted into light.

It is expected that such tubes will find practical use for special scientific experiments and among surgeons, due to the fact that the light they give off is of only one color and not composed like ordinary daylight of all the colors of the spectrum.

An idea following somewhat similar lines has been devised in this country for making luminous compounds. According to a patent recently granted, the phenomenon of phosphorescence can be produced by the reactions of two classes of substances known as "luminophores" and "phosphorogens" with a base of some mineral carbonate and a combustile material like starch or sulfur. Luminophores are compounds of the lighter metals such as sodium and potassium, while the phosphorogens are compounds of heavier metals like silver, nickel and the radioactive uranium and thorium. These latter make the limestone base phosphoresce and the former impart the desired color to the glow.

ZINC AND MARINE PESTS

SHIPS with zinc bottoms would never be fouled with barnacles. It has been fairly well known that there is a great difference in the ease with which marine animals grow on various metals, but it has never been exactly clear which of the latter were the most resistant or why. Professor G. H. Parker, of Harvard University, has undertaken to clear up some of these points by experiments conducted at the Marine Biological Laboratory at Woods Hole, Mass.

Metal plates were suspended in a wooden frame in the sea water of a pond with strong tidal circulation and after six weeks' submergence marine life was established on some of them half an inch thick. Aluminum, iron, tin and lead, it was found, sustained luxurious growth, but the surfaces of the copper and zinc plates were practically free.

The chemical explanation lies in the fact that the ions and soluble compounds of the heavy metals such as these are usually extremely poisonous. Where they are liberated from a metallic surface, such a surface is protected from organic growth. This is the case with zinc and copper, but the products of marine corrosion with the other four metals are insoluble; consequently the barnacles and their allies grow over them unchecked.

Professor Parker says, "By coupling copper with metals higher in the electromotive series, this metal can be rendered chemically inactive in sea water and, under such circumstances, animals will grow freely upon it. Zinc in this respect is much less easily controlled, for it lies high in the electromotive series and consequently it is not open to the electrochemical protection that copper is. Its compounds, moreover, are relatively freely soluble and thus become very effective in checking the growth of animals."

A NEW MEGAPHONE

A NEW megaphone which distributes sound over a greater area has been developed by Professor F. R. Watson, of the University of Illinois, authority on acoustics. Already cheer leaders at the universities of Illinois, Michigan, Wisconsin and Minnesota have adopted the new instrument and indications are that its use will soon become widespread.

The megaphone is constructed of tin; it is only a foot and a half in length and strangest of all, has only a narrow rectangular opening. It is almost flat in appearance and is used in a horizontal position with the rectangular opening in a vertical plane.

Construction of the megaphone is based on the sound diffraction theory that sound passing through a narrow aperture spreads out. The ordinary megaphone differs from Professor Watson's in that sound passing through it tends to travel only along the axes of the megaphone and not sideways. It permits only the people in front of the announcer to hear.

Sounds issued through the narrow opening of the new megaphone spread out in a wide area. The commonly-used megaphone can be used only to direct sound audibly along one plane.

Professor Watson conceived the idea of the invention more than ten years ago when he began research in acoustics. He developed it this year upon the request of Illinois athletic officials who became concerned as to how cheering could be better conducted in the large Illinois Memorial Stadium and the Illinois Basket ball Gymnasium.

Since the announcement of the invention, Professor Watson has received many requests concerning information about its construction. He is interested in having the instrument adopted and will willingly answer any questions.

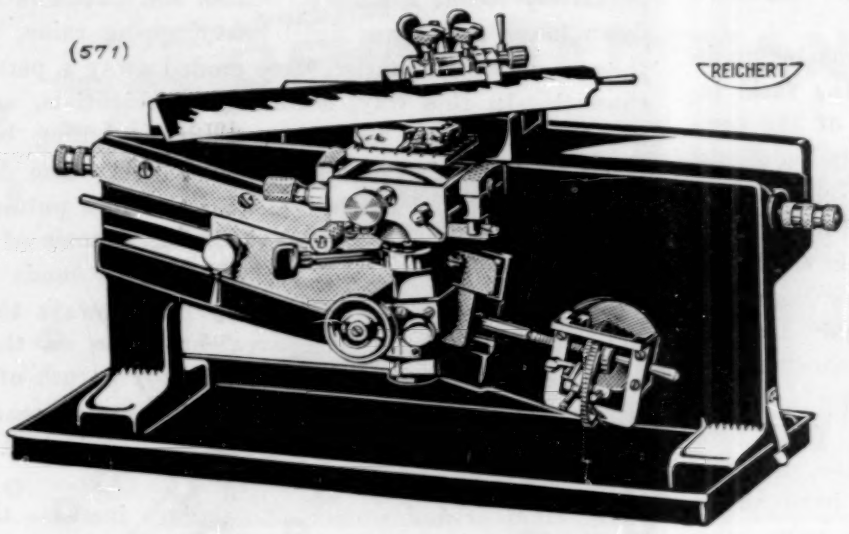
THE EXTERMINATION OF THE AMERICAN CHESTNUT

THE problem of quickly using up in the next few years the chestnut trees growing on the 33,000,000 acres of south Appalachian woods is confronting the U. S. Forest Service and the forestry departments of the various states to-day. Dr. G. F. Gravat and R. P. Marshall, forest pathologists of the U. S. Department of Agriculture, estimate that 80 per cent. of all the chestnut trees in more than half of the south Appalachian region will be blighted by 1930. By 1935 it is believed that nine tenths of forest area will have passed that stage.

Because the lumber shortage is already being felt in the United States, owners of chestnut trees are urged by the department to utilize their timber before the rot-

REICHERT MICROTOMES

(571)



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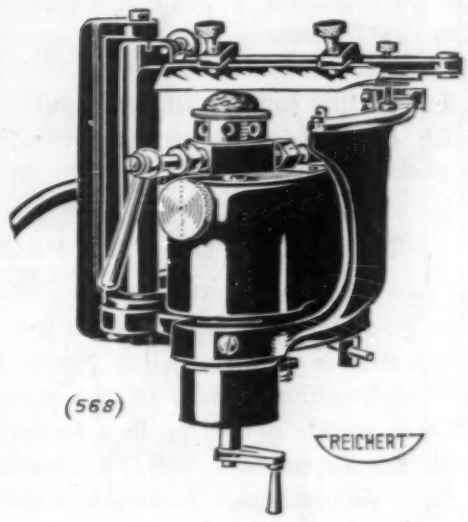

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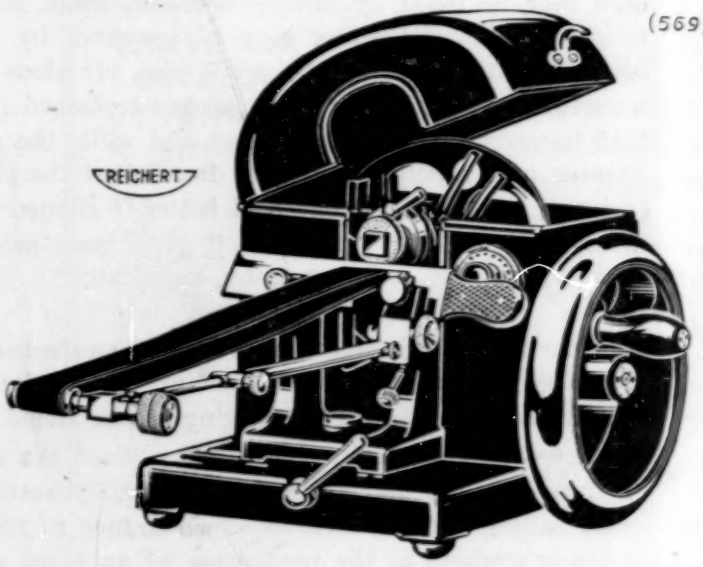

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ting that follows the blight has caused heavy losses. Tests made by the U. S. Forest Products Laboratory have shown that the blight alone does not impair the strength or durability of the wood. But like a tree ringed with an axe, a blight-killed chestnut when left standing is soon rotted by the wood-decaying fungi that gain a foothold in the dead tree.

The survey of the blighted area which was begun in 1924 and is still going on has shown that the fatal infection has now reached the southern limit of the commercial chestnut area. No practical control is known.

The organism that is killing the American chestnut by the wholesale is a foreign fungus that was brought into this country on contaminated nursery stock from Asia a few years ago. In its native home the fungus was not as deadly as in America for the trees had acquired a sort of immunity. Many foreign varieties of chestnut are being imported now with the hope of finding a blight-resisting kind to replace the ones destroyed. While none has yet been found that is wholly immune, a hairy Chinese variety and a Japanese chestnut have shown some natural resistance.

The American chestnut supplies half the tanning extract used in this country in the manufacture of leather, and with the species facing extermination, a new economic problem must be met.

THE EELS OF THE PACIFIC

THE man who found out where the eels of Europe and America go when they disappear in the fall has set out to solve a similar problem in the Pacific Ocean.

That the breeding ground of the common fresh water eels of both countries overlap in a section of the Atlantic south of the Bermuda Islands, a location thousands of miles from their summer homes, was ascertained largely through the researches of Dr. Johannes Schmidt, of the Carlsberg Laboratories of Copenhagen. For the last twenty years he has been studying young eels picked up in nets from points all over the Atlantic, working much of the time under very primitive conditions. The young eel larvae of both the American and European eels are hatched in the mysterious Sargasso Sea. How these elvers know which continent to make for when seized by the migratory urge to reach fresh water is a question the scientists refrain from answering, but, according to Dr. Schmidt, there is no record of their ever having made a mistake.

Having settled the question of the common fresh water eels which breed in the Atlantic, he has now turned his attention to those found in the Pacific and Indian Oceans about which there is very little scientific information available. He has just spent two months in Tahiti where he has collected a large mass of material and data that will be worked up and studied on his return to Copenhagen and from which it is hoped valuable information of the life history of the Pacific eels will be obtained.

During his stop in Washington Dr. Schmidt was made an honorary member of the Washington Academy of Sciences.

ITEMS

MANY of the creeks and roads of the Southwest may have had their origin in the paths worn by feet of the now almost extinct bison. Scientists in making a survey of the semi-arid lands of this section say that within comparatively recent times well beaten cow paths have worn down lower and lower until heavy spring rains, finding them a convenient outlet, have eroded away a permanent channel. In this way, according to scientists, some of the larger streams may trace their beginning back to paths made by the prehistoric mastodons. The development of bison and cattle trails into modern public highways has followed a somewhat similar process of evolution. The trails leading from the range lands to the markets of the North opened up passageways that the covered wagon found a convenient guide on the long trek to the Southwest. With the steady onrush of civilization the wagon roads of yesterday have become the concrete highways of to-day.

LUBRICANTS and proper size pulleys increase the life of rope, I. P. Blauser, of the University of Illinois, has learned after a study of conditions which benefit its use. Exterior coatings and lubricants prevent external wear and the rotting of fibers, he has found, while the proper size pulley checks internal destruction. The proper pulley should have a diameter which is at least eight times the diameter of the rope. A pulley at least seven inches in diameter should be used for a rope seven eighths of an inch in diameter, he claims. Useful exterior coating for rope may be made by mixing beeswax, black lead and tallow. Another covering may be prepared by mixing black lead, tallow and resin, while pine tar alone makes a useful coating in many cases, he has explained further. "If the mixtures are applied hot and while the rope is running over a pulley, it will be found that the preparation will penetrate a great deal better," Blauser stated in his explanation. "Mineral oil gives good protection against dampness and penetrates excellently."

CHEAPER, simpler processes in linen manufacture with a finished fabric less likely to fade are the results of the year announced at a recent meeting of the Linen Industry Research Association at Belfast. Since the making of linen involves many laborious and complicated processes, calling for the services of from four to six times as many workers as the production of an equal amount of cotton, any simplification is extremely desirable. A superior new strain of flax of Russian origin, more than a ton of which has been developed from a single seed planted fifteen years ago, is calculated to yield a plant of even growth, a very valuable quality, since the element of waste in the field has always been, in the past, a decided factor of loss. The spinning operations have been considerably simplified while the difficult aspects of bleaching and dyeing have received much attention with a view to diminishing the excessive loss in weight and changes which affect the dye-absorbing properties of the fibers.

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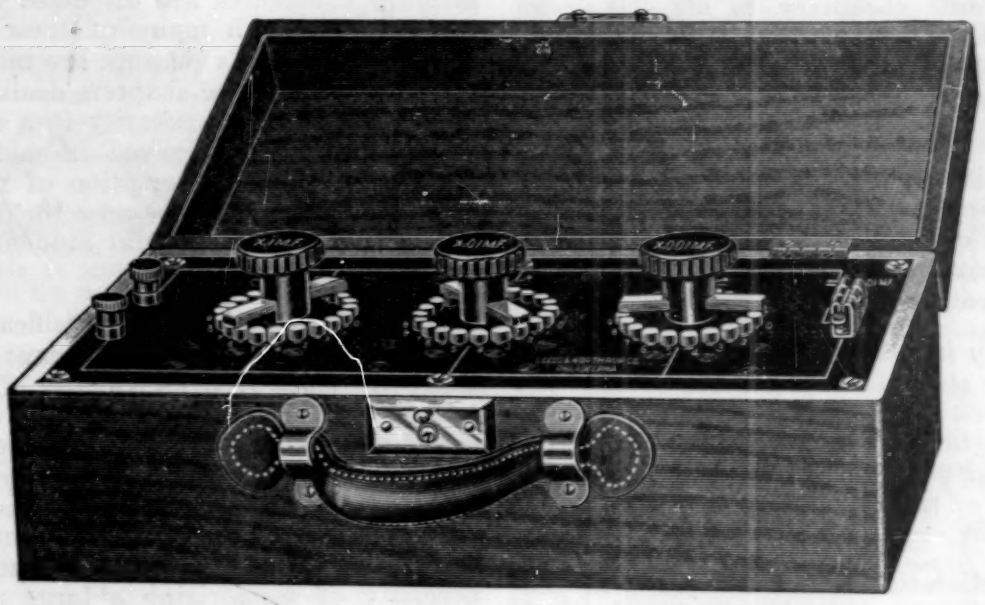

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NEW COLLEGE INORGANIC CHEMISTRY UNIQUE IN ORDER AND SUBJECT MATTER

The Macmillan Company Announces Publication in May

Professor Stuart R. Brinkley has for years been experimenting with a new method of approach to the study of inorganic chemistry in his classes at Yale University. This has involved both a distinct departure from the traditional order of topics treated and also an increased emphasis on the newer theories of chemistry.

The results of his experiments will appear in a text, **Principles of General Chemistry,** to be published by The Macmillan Company in May, 1926. Writing of the ideas which have motivated his treatment Prof. Brinkley stresses two distinctive features:

> (1) *The early introduction of the modern ideas of atomic structure and the use of the concepts involved throughout the course.*
>
> (2) *A departure from the traditional method of classifying the descriptive topics under the head of the Elements, substituting one using similar reactions as the basis.*

(1) The introduction of atomic structure in the first chapter immediately following the review of Dalton's Atomic Theory furnishes material which is new and fascinating to the student and arouses his interest at the very beginning of the course. In order to avoid undue difficulty, little more than an outline of the essential points is given at this stage. The further development and use of these concepts is gradual. The application of the electron idea to reactions of direct union is introduced in the second chapter. The electronic changes involved in electrolysis and displacement are considered in the chapter dealing with ionization. The application of the electron concept to oxidation-reduction phenomena is gradually developed further in the discussion of nitric and sulfuric acids and at this point is made a working hypothesis. The whole concept is recapitulated and finds further application in a later chapter dealing with Oxidation-Reduction.

For students who enter college with credit for high school chemistry this new approach offers a freshness that will hold their interest from the start and prevent that let-down which inevitably comes with the feeling that the college course is merely a "review" of previous work. In mixed classes those students who have had no previous work in chemistry will find the clear explanation of the electron theory in the first chapter and its gradual development in later chapters entirely understandable, while its use from the start avoids the necessity of different explanations for different reactions and phenomena.

(2) The classification of substances according to the kinds of reactions which they exhibit, instead of according to the elements which they contain, makes it possible to emphasize the generality of the reactions instead of studying each as a specific change. The author has, therefore, adopted the classification of compounds under the general types: basic oxides; acidic oxides; acids; bases; and salts. The reactions exhibited by these compounds are of much more general application than most of those exhibited by the elementary substances. Because of these facts and because of their lesser importance, the specific elementary substances are discussed toward the end of the text, although many of their more general reactions, for obvious reasons, are included in the study of compounds. The chapters dealing with the metals have been devoted primarily to a discussion of some of the principles involved in metallurgy. For the most part specific description of metallurgical processes has been omitted because the details of operation differ and for the general student are not of very great importance.

By using this scheme of classification, general principles are stressed and the student who continues his study of chemistry no further than the first year college course gains an insight into the scientific method of study, and acquires something of the point of view of the chemist and a concept of the importance of the science. At the same time the student who goes on to more advanced courses in chemistry is equipped with the tools he requires without the necessity of memorizing a large number of apparently unrelated facts.

Under each of the types of compounds, the general reactions are studied first, after which specific substances are considered. The latter can be omitted if the time devoted to the course makes this desirable, without detracting from the general survey of the subject.

In considering the applications of the various sub-
author has been guided by the belief that these ap-
author has been guided by the belief that these applications mean something to the student only when he sees the reason for them. The applications and uses are therefore interpreted in the light of the reactions and properties of the substances themselves.

A series of *exercises* at the end of each chapter serves to direct the attention of the student to certain of the more important topics under consideration. At the end of each chapter *references* to supplementary reading are given. Some of the articles to which reference is made are written in non-technical language for the interest of the general reader. Others are more difficult and require careful study and thought.

Teachers of college chemistry desiring to examine the **Brinkley: Principles of General Chemistry** will gladly be mailed a copy on publication in May on request to

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SCIENCE NEWS

Science Service, Washington, D. C.

OPEN AIR ACOUSTICS

A SPEAKER may be heard more clearly and accurately in the open air than in any auditorium. This conclusion, following elaborate experimentation by Dr. Vern O. Knudsen, physicist in the University of California, Southern Branch, is a contradiction of the widespread idea that a properly constructed auditorium reinforces and improves audibility. The walls of such a room may increase the general loudness of speech-sounds, but the interference of reverberation more than counteracts the presumed advantage. In one test of an auditor's accuracy in understanding speech it was found that a listener 100 feet from a speaker in the open-air Hollywood Bowl made a better record than he could even in the best Los Angeles auditorium available.

More precise tests were carried on with the aid of an oscillating amplifier—the equivalent of a "howling" radio set. This device yielded a sound electrically controlled and maintained at a set value just 1,000 times the amplitude of a barely audible sound. The "howl," suddenly interrupted, reverberated for five seconds in a test room with a cement floor and no furniture. When a set of meaningless speech-sounds was spoken in this room, the auditor got only 50 per cent. of them correctly.

The room was now gradually padded more and more completely, as time went on, with a one-inch layer of hair-felt. Reverberation was steadily shortened. Finally with maximum padding, 92 per cent. accuracy in speech understanding was attained, while the reverberation time had shrunk to six tenths of a second. This is considered the limit in acoustic clearness indoors; but when the experimenters moved outdoors the accuracy rose to 95.7 per cent. exceeding the best record of a padded room and much ahead of any regular auditorium. Higher accuracy than 95.7 is improbable, as the auditors make a few mistakes in any case. These occur with end consonants, especially "th" and "ng," and not with vowel sounds.

Concave sounding boards located back of a rostrum are considered by Dr. Knudsen of appreciable acoustic value, but are generally architectural misfits. Auditorium walls in any common position are simply a necessary nuisance. Music halls, where clearness of speech articulation is of minor concern, are not directly considered in the work described; nor is any account taken of peculiar halls where a rear-seat auditor can hear a pin drop on the stage. Such a stunt may have no relation to the value of the auditorium for continuous speech.

The moral of all this to the architect seems to be—break the rules of scientific acoustics if you have to in order to avoid spoiling an artistic design; then spend some money on padding. In view of the expense and other disadvantages of hair-felt, the field is now open for a porous, spongy wallplaster which may absorb more of the stray sound than common hard plaster, and thus prevent reverberation.

THE CONSTITUTION OF THE ATOM

THAT particles even smaller than the electrons, hitherto supposed to be the smallest things in the world, surround the parts of which atoms are built up, and that this hypothesis may reconcile the old wave theory of light and the newer "quantum" theory, is the suggestion made by Sir Joseph Thomson in his recent Kelvin lecture before the Institution of Electrical Engineers. According to modern notions, an atom consists of a central, rather massive, nucleus charged with positive electricity called a proton, surrounded at relatively great distances by ultra-minute particles of negative electricity called electrons, which rotate in different orbits around the nucleus.

In order to reconcile the modern view that energy is emitted in small separate bundles or "quanta," with the older ideas, Sir Joseph said, it is necessary to assume that both the proton and its satellite electrons are surrounded by an atmosphere of much smaller particles, the impact of which on the protons and electrons causes them to vibrate and send out energy. "Both proton and electron must be regarded as nebular systems," he stated.

Theory indicates that the vibrations or oscillatory movements of protons and electrons should give rise to electrical waves, and Sir Joseph believes that such waves are actually produced, although ordinarily they are unable to escape from the outer confines of the atom, being reflected back into the interior. The so-called "quanta" of light he believes to consist of bundles of electrical waves shot out from the atom at the same time as ordinary electromagnetic waves.

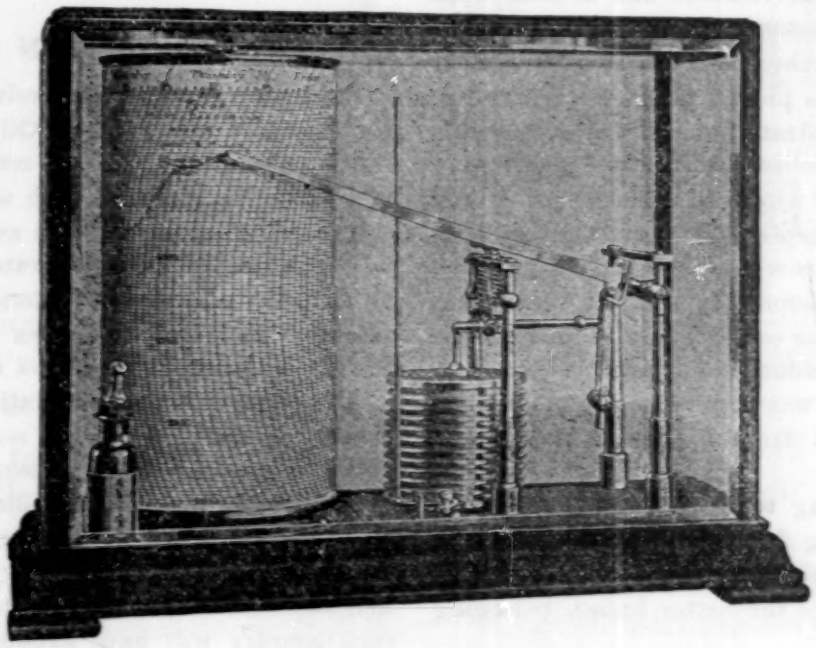
INFANTILE PARALYSIS

A TEST that will indicate whether or not children are susceptible to infantile paralysis has probably been found by Dr. Edward C. Rosenow, of the division of experimental bacteriology of the Mayo Foundation.

Redness of the skin at the end of eighteen to twenty-four hours at the point where suspensions of the streptococcus from infantile paralysis are injected is thought to indicate susceptibility. Complete lack of redness is considered to show that the person is immune. A serum prepared from the blood of horses immunized with the streptococcus prevents this toxic reaction.

Dr. Rosenow cites as supporting evidence for his contention: "the absence of marked reactions in persons fully recovered from poliomyelitis, the strongly positive reactions during the acute stage of the disease, and the negative reaction during convalescence."

Skin tests that indicate susceptibility to scarlet fever and diphtheria are already in widespread use in medical practice. Children whose skins show positive reactions are then immunized to prevent their succumbing to the disease in question. At the present time no antitoxin for infantile paralysis has been developed and there are numerous points regarding the skin reaction described that have not yet been worked out, according to Dr. Rosenow.



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POISONING FROM MERCURY VAPOR

THE insidious poisonous effects upon himself of mercury vapor, utilized in a period of research experiments extending over twenty years, have been described in a scientific paper by the famous chemist, Professor Alfred Stock, of the Kaiser Wilhelm Institute. Chronic troubles of the nose, throat and intestines were rendered more aggravating by increasing nervousness and as time went on his naturally excellent memory and powers of concentration grew weaker and weaker. No course of treatment prescribed by his physicians proved permanently helpful.

Eventually it became evident that collaborators in his own laboratory as well as colleagues in other places were being affected in the same way. In consequence it was decided to readjust laboratory conditions so that as little free mercury would be exposed to the air as possible. And at the same time a thoroughly efficient ventilating system was installed. In the course of a few months the various ailments fell off gradually and after a period of years health in some cases was restored completely when the experimenter refrained from further contacts with the element.

Medical science, according to Professor Stock, is not aware of the danger arising from the inhalation of mercury fumes, the chronic poisoning from which, in his opinion, is quite as fatal as the better known poisoning from lead.

SCIENTIFIC FARMING ALONG THE VOLGA

SOME 77,000,000 roubles (about $35,000,000) have been appropriated by the Soviet government to fend off famines in the Volga district. On experimental farms attempts are being made to find the best system of crop raising to offset the disadvantages of the irregular rainfall in the famous famine region of southeast Russia known as the Lower and Middle Volga.

The average precipitation in this huge section is only 16 inches per year, conditions which are about the same as those in the state of Utah, according to a report by N. M. Toulaikoff, director of the agricultural experiment station at Saratoff, made to a committee of the Geographical Society of Geneva studying world calamities. The same conditions prevail in the south of the Ukraine and a considerable part of northern Caucasus.

If advantage were taken of all the natural factors which go to make up the local climate and if modern methods of agriculture were used, there would be enough moisture to insure a regular succession of crops. Taken as a whole this part of Russia has never been intensively cultivated and in consequence is very fertile. Rye and summer wheat cultivated under modern conditions have been made to produce heavier yields than were ever before obtained in this section. Introduction of Indian corn, millet, beets and other vegetables which do well in hot weather might very profitably lead to cattle breeding and an increased milk supply.

Since drought in April, May and June always spelled disaster to 90 per cent. of the usual crops sown, in the old days the peasants always kept on hand reserve supplies to carry them over the bad years. Agricultural conditions, however, like everything else, have been completely unbalanced with consequent distress to the rural population.

The only solution, according to M. Toulaikoff, lies in building up a carefully organized system of farming that takes full advantage of natural local conditions, since irrigation on such a large scale and under present conditions is out of the question.

WATER POLLUTION FROM WASTE OIL

REPRESENTATIVES from twelve nations attended the International Conference on Oil Pollution in Washington which considered means to make the oil discharge from vessels vanish from the high seas.

The rapid increase in the number of oil-burning ships has rendered the matter of water pollution from the waste oil a matter of world importance for the discharge, being insoluble in water, is driven ashore by the wind with serious detrimental effects on bathers and fish alike.

All attempts to pass regulations effecting total prohibition of discharge of oil at sea have been abandoned in favor of a system of permanent zoning. Vessels will only be allowed to make such a discharge not less than fifty miles off shore and not farther than 150. Zones can be established by a nation only with the consent of its neighbor nations, which in actual practice means that each country will have to work out its own particular zoning problem.

There was considerable discussion during some of the sessions of the installation of separating machinery that would reclaim fully 40 per cent. of the waste oil which could be used over again. Since apparatus of this sort would pay for itself in a few years several delegates strongly advocated this solution of the difficulty. The high initial costs as well as increased tonnage, however, were felt by the majority to be arguments against the oil separators.

The rest of the time allotted to the conference will be taken up with the problem of enforcement of the regulations just passed, a question of major importance since legal jurisdiction over a vessel out at sea beyond the reach of observation is difficult to maintain.

A NEANDERTHAL SKULL

PORTIONS of a human skull, including the frontal bone, belonging to the Neanderthal race that vanished from the earth about 25,000 years ago have been discovered at Devil's Tower, Gibraltar, by Daisy E. Garrod, of Oxford University. The bones were buried at a depth of ten feet and with them were the rude stone implements used by these cave men of prehistoric Europe. The discovery is regarded by anthropologists as being of considerable importance because it corroborates the data of a similar discovery made at Gibraltar in 1848.

The Gibraltar skull brought to light seventy-eight years ago was a historic event since it gave the first clue to a branch of the human race very different from people of today. But this significance of the skull was not realized until 1856, when a skeleton of the same peculiar type was unearthed at the Neanderthal region in Prussia. This

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Barnett Sure, Univ. Ark., reported *increased milk secretion in nursing mothers,* when fed liberal amounts of Yeast Vitamine-Harris Tablets.

H. J. Gerstenberger, Lakeside Hospital, Cleveland, Ohio, reported a series of cases of *Herpetic Stomatitis* and *Herpes Labialis,* cured with addition of Yeast Vitamine-Harris Tablets to the regular diet.

Goldberger and Tanner, U. S. P. H. Service, reported *cures of black tongue in dogs,* when fed Brewers' Yeast-Harris (medicinal).

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Neanderthal skeleton was so strange that it was at first regarded as the body of a man misshapen by some terrible disease or deformity, but later finds proved the existence of an entire race with large flat skulls; great ridges over the brows; snout-like noses, probably unlike any noses that we have any conception of; thick, clumsy joints; heads carried heavily bent forward. The remains of this type of human being have been found in widely scattered places in Europe, and evidence indicates that the race existed for some 50,000 years in the era before the last great ice age.

The first Gibraltar skull could be dated no more exactly than to say that it belonged to the Neanderthal race of the Mousterian age. It is possible that this skull will enable anthropologists to find out more definitely when, why and how these extinct people made their cave homes in southern Spain.

THE CASEY COLLECTION OF BEETLES

THE insect collection of the National Museum, already one of the most valuable in the world, has been enriched by the well-known beetle collection of the late Colonel T. L. Casey, whose study of these insects had earned for him an international reputation.

For several decades Colonel Casey collected beetles, large and small, for he had a preference for those of microscopic size, at the numerous army posts at which he was stationed in the United States and in different countries in which he saw foreign service. The resulting collection comprises an accumulation of North American beetles which is one of the most complete in existence and contains as well many rare specimens from South America and other parts of the world. Colonel Casey published in all twenty volumes and many shorter scientific papers on the beetles to which he devoted so much of his life.

Being a private collector of independent means, Colonel Casey was able to indulge his fancy and at the same time add to the sum total of scientific knowledge, by studying many rare, little known species for which most specialists can spare little time from their investigation of insects of greater economic importance.

The Casey collection does include, however, many economic species that attack standing timber as well as numerous genera of weevils that are injurious to the roots and seeds of crops. These groups are being rearranged and made available for study in the museum; those of greater economic importance receiving earlier attention so that specialists may have access to them for study at as early a date as possible.

This collection brings around 6,000 type specimens to the national collection, including nearly 4,000 not in its possession before, and opens up to scientists a wealth of valuable material for study.

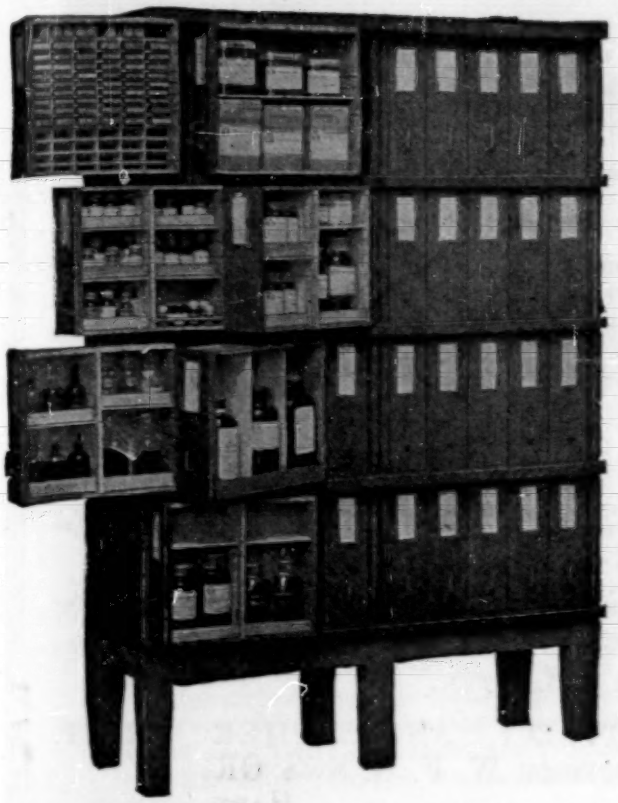
ITEMS

THE addition of one per cent. of metallic cadmium to copper trolley wire produces an alloy which lasts about three times as long as the ordinary copper wire, it has been revealed in tests conducted on British and Canadian trolley lines. One stretch of double track, over which some fifty cars passed in an hour, was equipped with two different wires, the copper wire wearing down several times faster than the alloy. The tensile strength of the alloy, for the same size of wire, is nearly double that of the copper. In one series of tests, reported Dr. N. F. Budgen, British scientist, copper wire after 130 days of service had worn down 6 per cent., a cadmium-copper wire of the same gauge having lost only 12 per cent. after 730 days of service. In another set of experiments the copper wire after 602 days had diminished 31.5 per cent. and in the same interval the cadmium-copper wire had lost only 8.2 per cent. The power loss due to a slightly poorer electrical conductivity of the alloy is low.

TWO thousand minnows from the U. S. Bureau of Fisheries are *en route* for Buenos Aires to help stamp out malaria in the South American republic. Top minnows are voracious feeders on the larvae of the mosquito carriers of the germ causing malarial fever. These larvae breed only in stagnant water and being air breathers stay almost entirely on the surface. Pools too large to have the air supply cut off by a film of oil have in many parts of this country been stocked with top minnows which have proved efficacious aids in keeping down the numbers of the anopheles mosquito. The minnows have been sent from the Bureau of Fisheries at the request of the International Health Board to be used for breeding purposes and distributed throughout the malarial regions of Argentina to help in the campaign of that organization to rid the Americas of malaria and yellow fever.

IN the Dead Sea a search for the two elements still missing from the chemist's periodic table has been made. The high concentration of salts in this famous body of water caused J. Newton Friend, of the Municipal Technical School of Birmingham, to consider the possibility of their containing either eka-caesium or eka-iodine. Diffractionations of samples of the water were accordingly carried out and the final diffractionation products submitted to X-ray analysis, but unfortunately the spectrum lines that would reveal the presence of either the one or the other failed to show up. Traces of the element strontium, however, were found, the presence of which had never before been recorded in any previous analyses of Dead Sea water.

ALL native attempts in China to imitate western furniture have been conspicuously unsuccessful, but the great demand for Chinese carvings and objects of art as decorations in occidental homes has led to their adaption in articles of furniture of European style and utility but Chinese in design. At first old carved wood-work decorations from shop fronts and ruined temples were incorporated into such pieces as screens, tables, chairs and even mirrors, but as the supply threatened to run out the native artisans were called in to meet the demand by using the older motifs as models for reproductions. The results have been so successful that a whole new industry has sprung up with products of real artistic merit, it is stated. Teak is the wood chiefly used which lends itself to a variety of finishes of great beauty.



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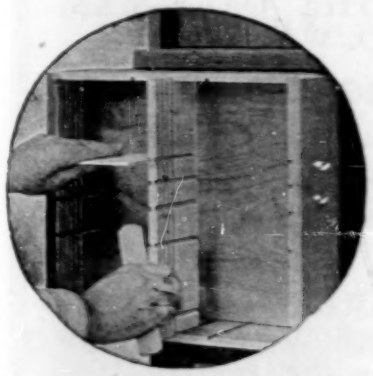

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What is an Element? Roger C. Wells.

THE PROGRESS OF SCIENCE:

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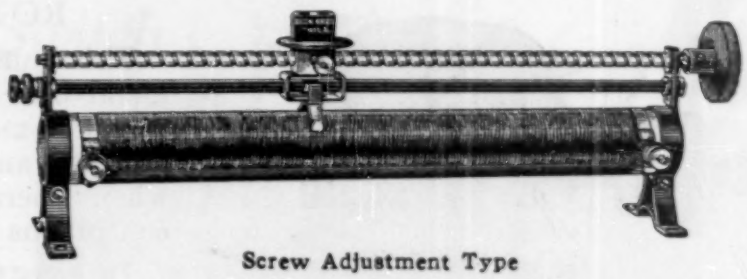

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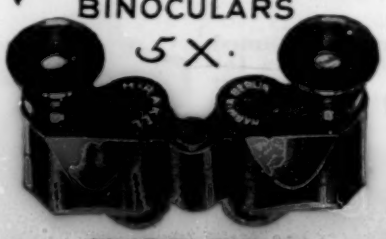

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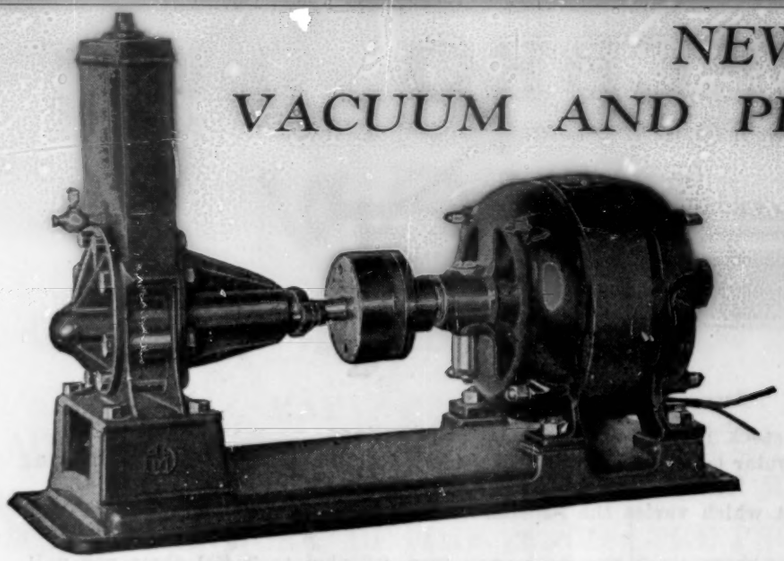

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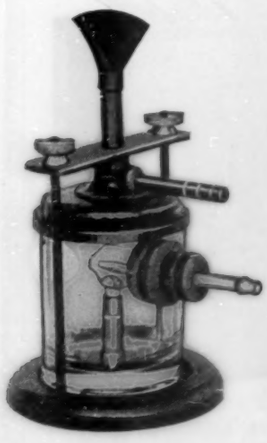

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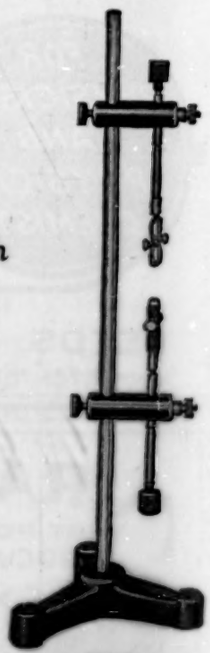

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